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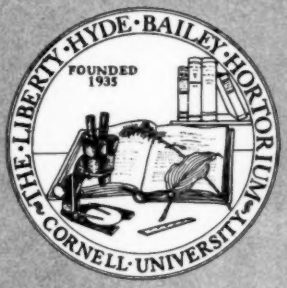

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BAILEYA
Vol. 6 June 1958 No. 2

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Botanical Explorations of Liberty Hyde Bailey
2. The Caribbean Islands and Bermuda[1]

Mary H. Moon

The story of Liberty Hyde Bailey's travels and collections in the American tropics is basically an account of his studies of the palms. These studies were the result of his dipping into a plant group new to him merely to satisfy a curiosity, only to find the state of knowledge so incomplete as to be misleading. Student and scholar that he was, he would not turn from it with a shrug of indifference. After all, he had included the palms in his encyclopedias, and so he owed it to the users of his works to provide useful accounts of the identification and names of those plants. He lived with the knowledge that the published accounts were in error, that the user would continue to be lead astray until they had been corrected. This realization first came to him about 1910, when Bailey was past his mid-century mark, but it was to be another ten years before he commenced serious work on the palms. As soon as the opportunity did present itself, Bailey dug down to the roots of the problem, found the causes of confusion, and then devoted the better part of three decades to properly piecing together the parts of the puzzle.

The underlying cause of the confusion in palm taxonomy and nomenclature was the inadequacy of the preserved material on which were based the species set up by botanists in the past. But why was it true of palms, and not of most other plants? Some kinds of palms are only small shrubs at maturity, and others are tough, spiny, thicket-forming vines, but the majority are trees: trees with tall, slender, unbranched trunks and a crown of leaves that is often well over one hundred feet above the ground; trees with huge, tough, leathery leaves, some weighing fifty pounds and measuring forty feet or more in length; trees with giant clusters of flowers and fruit whose botanically important bracts are trough-shaped woody envelopes up to ten feet long. Plant parts of these dimensions do not lend themselves to being pasted on the conventional herbarium sheet measuring about 12 × 18 inches! Yet it was

[1] During some of the trips accounted for here L. H. Bailey visited also some South American countries and their off-shore islands. These will be treated in detail in the third part of this series.

only such mounted fragments of leaf tips, of flowering branches, or of fruit-shells that Bailey found in the world's museums, where they served as the documentary record of the diagnostic parts of most of these forest giants. It is small wonder that the true characters of the plants were not accurately described in the literature, or that there was no simple way to verify or correct them.

Bailey's first task was to set minimum standards for redocumenting the known palms and for establishing bases for new ones yet to be discovered. His method was to assign a collection number to a particular palm tree; to collect from it a typical leaf and its often sheathing base (no matter how large); to spread it on the ground to photograph it; to cut the leaf into sections, folding each to fit a folder the size of the herbarium sheet, and tagging each part with the same number given the tree. He would cut down a complete flowering or fruiting inflorescence, photograph it if it was large, and preserve the woody boat-shaped bracts or spathes by cutting them into 18-inch sections when necessary. He would retain either the entire inflorescence or major sections of it, often preserving flowers or fruits from it in liquid. Here, too, each item would be tagged with the tree's assigned number. This was time-consuming, often requiring a day or more. When the tree could not be climbed, it had to be felled. This sometimes required authorization from the owner - and more time consumed.

Photographing often was most difficult. Clearings sometimes had to be cut to admit light or to permit a view of the crown of foliage. Very often assistants were hired to do the high climbing or the tree-felling. Frequently Bailey would be wet the day through, unmindful of needing a midday meal, striving to keep his film dry, his field notes legible; and most of these productive years were before the days of modern insect repellents. But he got his specimens and his photographs.

The collection of palm material he assembled at Ithaca is certainly the world's finest, qualitatively if not quantitatively. It is small wonder that predecessors had failed to get "the stuff," as Bailey would express it. And it is small wonder that Bailey's quests for palms of the Caribbean provided him with anecdotal material wondrous to listen to. However, he was always sensitive lest listeners remember the anecdote only to forget the primary reason for the quest. This was one reason why he would never write memoirs. To him, the experiences were truly incidental to getting the specimens.

All of this palm interest began in his fifty-second year, in 1910, when, according to reports, his wife chided him for not knowing the names of the palms she pointed out to him from a hotel veranda at Kingston, Jamaica. Bailey prided himself on his knowledge of garden plants, and her gentle teasing stimulated him to make the decision to learn about the palms.

It was very much in character that Bailey did not start with those particular planted palms whose names he did not know. He followed his larger plan: his guiding rule, that study of any group of garden plants must be based first on knowing the wild members of the group, and that the identification and naming of the cultivated kinds will then later fall into place. So, Bailey started his journeys to see the wild palms - to the volcanic islands of the Caribbean, to the jungles of Panama and South America, to the hinterland of Mexico, and to the less traveled areas of our southern states. He visited the Caribbean area itself on eighteen different occasions from 1910 to 1949, and collected palms and other plants on at least thirty-one of the islands in the two Antilles chains.

Each of these trips was an adventure in itself. There is much we do not know about them because Bailey kept no detailed journal, no diary, and did not later write very many anecdotes. Too seldom was much recorded of his informal talks about the trips. What we do know is indeed fascinating. Our knowledge comes from his botanical writings in which he named and described the new species he had found, from his fragmentary notes accompanying the plant specimens, and from the few recordings that were made of his talks in the 1950's.

Among these recordings is his account of his 1935 trip to Andros Island. This was an adventure with all the elements of a movie melodrama: hurricanes, famine and thirst, a shipboard fight, and a cast that included two young Englishmen who were studying diseases of the Caribbean sponges, and an internationally famous swimmer. To the non-botanist, the finding of a new species of palm becomes incidental. Space considerations prevent inclusion of the story in this article, but it will be among those given in full in the forthcoming biography now in preparation.

Sabal is the Latin name of the palmetto palms, a large genus to which Bailey devoted considerable study. He collected its members from many places in the Caribbean: Bermuda in 1922; Dominica in 1922; Cuba in 1929, 1931, and 1938; Puerto Rico in 1932 and 1939; Martinique in 1938; and, of course, many times in Mexico and the southern United States. In addition, he received material from other collectors and studied specimens in the major herbaria. By seeing and photographing the palms in their native haunts, bringing back specimens of their foliage, their flowers, and their fruits, he assembled - often for the first time - an indisputable documentary record of their characteristics. It was through the subsequent painstaking study of this record that he was able to put the pieces together and produce a true picture of their relationships. In 1940 he wrote, "Several undescribed species of Sabal are in my collection awaiting the experience and opportunity to publish a complete revision. The palmettos are so common in cultivation and so abundant in nature that they invite continued attention."

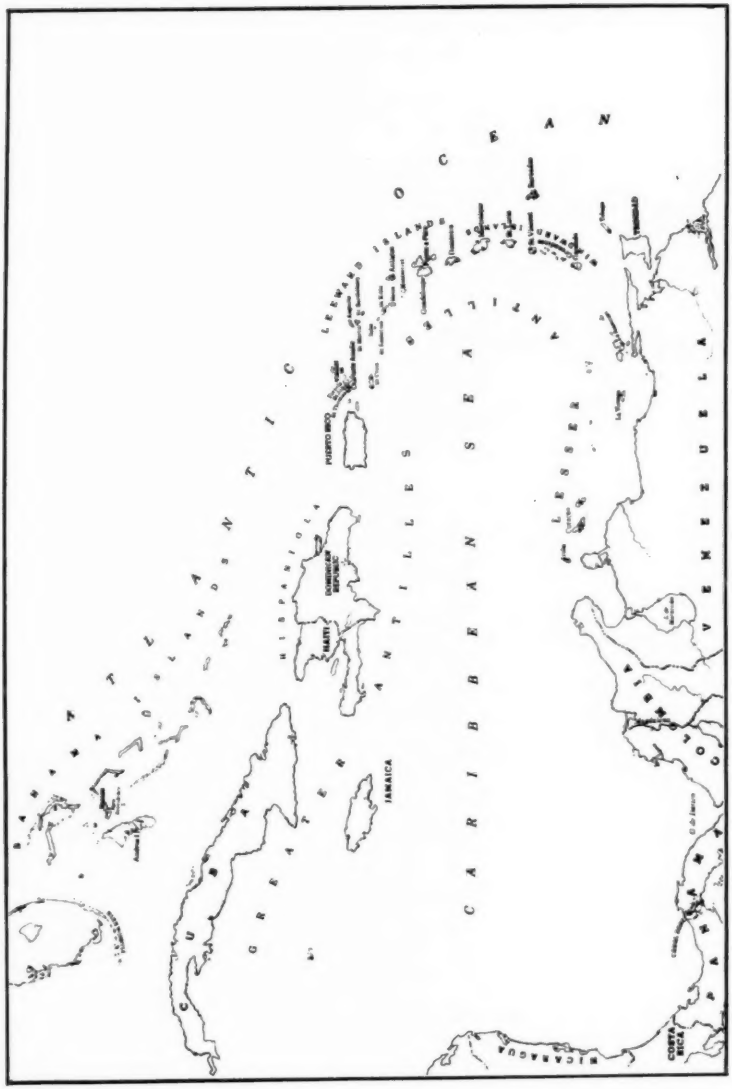

Fig. 14. Map of the Caribbean region which Dr. Bailey explored intensively for palms.

Four years later he penned confidently, in Gentes Herbarum, as he monographed the genus, "The genus Sabal begins to take cohesive shape in my mind ... ardent growing collections in many regions have been studied, bundles of sterile and fragmentary material in my herbarium have been burned, and now the way is clear. We should have an encouraging journey."

The journey was more than encouraging, it became satisfying for in addition to recognizing and naming the new species Sabal bahamensis, he named and published Sabal peregrina, based on material he had collected on Martinique, and Sabal yucatanica of Mexico. He also brought together most of the information known about other species, a valuable contribution in itself.

Four other palm genera also held particular fascination for Bailey: Thrinax (the peaberry palms), Acrocomia (the gru-gru palms), Coccothrinax (the seamberry palms), and Roystonea (the royal palms). His Caribbean palm collections were coordinated with specimens he collected in other parts of the American tropics, the whole being studied together, and the results published in Gentes Herbarum.

Blackberries and their relatives belong to the genus Rubus. This was another of Bailey's favorite groups, and for seventy years was the object of his studies. His Rubus studies in the Caribbean, while not so important in their results as was his palm work, nonetheless helped him gain a perspective on their interrelationships with those of the North American continent.

Travel restrictions imposed by World War II forced Bailey to suspend palm exploration activities. Restive and impatient at this, he conserved allocations of rationed gasoline so that he might fill in broad gaps of knowledge by collecting Rubus in hitherto unstudied areas in the United States. In those war years he canvassed southern and eastern parts of the country, collecting the wild blackberries. However, during this period he never abandoned his plan for studying thoroughly the palms of the Caribbean. The war over in 1946, he was back for them once more in that area.

To record the scope and results of each trip is not possible at this time. A list of the new palm species Bailey discovered and named, and of the dates and major stopping places of his Caribbean trips, is appended to this article.

In the course of his studies Bailey kept clearly in mind that, next to adding to man's knowledge through scientific investigation, his most important contribution would be to make these findings available to the plantsman and the gardener. He did this by writing new descriptions in a language that was both meaningful and understandable, and by basing his accounts on his observations of the plants and their structures. He did it, too, by going back to the earliest literature, sifting the reliable from the unreliable, and giving

the reader not only the correct name for each plant, but readable explanations of why that name was correct.

Bailey was noted for his singleness of purpose and his energy. These attributes are well exemplified by the way he planned his trips and went about making the collections. He was always prepared and knew the particulars of each plant he was searching for. On every trip he carried with him a hatchet, machete, and a saw; a plant press and drying papers to preserve the specimens, even wrapping paper and cord for the parcels; storage boxes; a bulky 5 x 7 camera and tripod, film-developing materials, and photographic accessories.

Bailey would spend a day or more in one locale to get the photographs, fruit, flowers, and leaves essential for an adequate record of a single palm tree. Knowing he might not come that way again, he would develop his negatives on the spot to assure himself that he had good pictures before leaving. (Once, he incurred the wrath of guests and management because he used up the hotel's limited water supply to wash his negatives.)

Seldom did terrain prove insurmountable when the plant he wanted was there. He was "on top of Haiti" (about 6,000 feet above sea level) in 1937, and at the town of Bottom, in Saba, in 1948. He collected in the almost inaccessible Oriente province of southeastern Cuba, and over most of Trinidad, Tobago, and Little Tobago. In Gentes Herbarum he wrote, "The llume or Gaussia of Puerto Rico is on inaccessible castellated limestone steepes high above the road. All day long I have hunted Raphia in water from knees to hips...." And he got his specimens.

On most of his later expeditions Bailey traveled alone. In the 1920's, however, Mrs. Bailey and their daughter Ethel accompanied him on several trips to the Caribbean and South America. A trip into Brazil in 1922-23 was the last out of the country for Mrs. Bailey, who later in 1923 suffered a stroke from which she never fully recovered.

Ethel Bailey's last collecting foray with her father was a few months after her mother's death, when, in November 1938, they went to Martinique. It was a rigorous, exhausting trip, associated with landslides, filthy hovels, and food poisoning, and Ethel's laconic field notes read: "Changed packs today, blisters bad ... climbed up-hill most of day; in awful native hut in rain ... roads flooded, father has fever ... both ill but finished packing."

Ethel Bailey's part as his assistant was indeed considerable. It was usually Ethel who pressed the specimens, who spread the hundreds of damp or wet blotters out to dry -- on a lawn, a hotel roof, or a veranda - or who scrambled for them when a quick tropical shower came down. It was usually Ethel who wrapped the parcels of specimens for shipment home, who scrounged for precious news-

papers in which to press the plants, and who worked by her father's side getting the material to be pressed. Her name, too, is fittingly commemorated in new species they discovered together.

Bailey usually engaged local help, both as guides and porters. The native islander would climb the tall palm to cut carefully an entire leaf, the fruiting cluster, or the bulky flowering branch that Bailey would need, sometimes lowering it with cord or rope to deliver it below, intact. Often the guide located the hut where Bailey could sleep for the night, bought the chicken to be cooked for food, or knew where beer could be bought for drink - it was safer than water.

Bailey would sometimes make arrangements with persons living in areas to which he could not return in the proper season, to send him the palm parts he wanted from trees that he had marked. When Bailey collected in Hispaniola, for example, he had the help of Félix Pierre Louis, of the Botany Department of the Services du Département de l'Agriculture Damien. On Antigua, Bailey met an old resident who had himself "introduced seeds of royals from Trinidad and had grown trees on his place in the hills, and from these trees he had seen the clumps arise in many places down the valleys."

Brother Léon was one of the persons whom Bailey always contacted when he was in Cuba. This French-Canadian priest taught at the Colegio de la Salle, a Catholic college in Havana, and of course spoke fluent Spanish. In 1951 Bailey recounted an adventure they had shared many years earlier when going by train to get some palms he wanted. Both had become thirsty in the tropic heat.

> "We stopped at a small station where venders, as usual, were selling all sorts of things, including beer. He lowered the window and bought two bottles. I didn't have any apparatus for getting the cap off the bottle of beer, so Brother Léon unbuttoned his robe, and drew out a machete. He held the bottle up at arm's length while standing in the aisle, and took a long-armed swipe with the machete and clipped the cap off as slick as a whistle. He had done that before! ... He was a rare old man. I loved him very much."

When one is confronted with the lists of islands Bailey visited, one is impressed by the number of places where he stopped, by the distances he covered. In fact, his whole life seems one continuous voyage, with longer or shorter stops here and there. The two Antilles chains extend for some 15,000 miles; their islands vary from a few to over one hundred miles apart. Bailey sometimes traveled back and forth between two islands several times during a single tour of the area. On one of his trips, in 1922 for example, he covered about 1,800 miles in three months. On six successive days his stops were at St. Kitts, Antigua, Montserrat, Dominica,

St. Lucia, and Barbados, in that order, and during these short visits he prepared over one hundred specimens.

These figures are the more impressive when one remembers that in those days one could reach the islands only by boat. Often he never knew until he arrived at a dock whether he could hire a small boat or find a skipper to sail him where he wished to go.

Things were very different on his last three trips to the Caribbean, in 1946, 1948, 1949. The airplane had taken over, and its scheduled flights revolutionized Bailey's itinerary-making. He could reach objectives sooner and could plan trips to islands never visited before. These trips seem to have been greater adventures than most of his earlier ones.

Bailey flew down to the Caribbean in January, 1948, and spent three months visiting a dozen islands for palms. He had a penchant for being away from home on his birthday, March 15. In his later years this gave opportunity to recall, for example, that on his seventy-ninth birthday he was in Port-au-Prince, Haiti; on his eighty-second in Oaxaca, Mexico; on his eighty-eighth in Trinidad; on his ninetieth on Grenada; and on his ninety-first at sea on a small sailboat between St. Eustatius and St. Kitts. The next four birthdays were spent at home.

When he turned ninety, he was collecting palms at the Grand Étang in Grenada. Friends at Cornell University had made other plans for that day - they were to have had a ninetieth birthday party for him - but had to wait on their guest of honor's convenience. The party was held after he returned home in May. He had wonderful stories to tell, and he told them well.

The Dutch island of Saba was one of his goals that year. He had been told that a certain species of Coccothrinax was not to be found there. Bailey was convinced by earlier studies that it was. The fact that an earlier collector had not discovered the palm was unconvincing. To learn for himself, he chartered a sloop to take him there from St. Martin.

The skipper of the sloop, the "Blue Peter," was understandably concerned when the aged white-haired man asked to be taken to Saba that seventh of February. His concern grew when next day they had to "beach" at Saba in choppy water. There was no pier, no harbor. The coast is rocky at the base of this volcanic crater island and one landed by wading ashore. This time the sea was too rough, the breakers too high for any casual wading. Two sailors formed a cradle and, shoulder-deep in the water, carried Bailey - waves breaking over the heads of all three - to the rocky shore. Drenched and shaken, he was nonetheless eager to climb the steep slope to the rim of the volcano cone, to descend to the little town of Bottom nestled deep within its crater. There was no transportation. Everyone climbed up one side and down the other.

Despite his being ill much of the time while on Saba, and flouting the doctor's orders to remain in bed, Bailey set out to look for his palm. He was not disappointed. The Coccothrinax was there, and he got his specimens. Later he named it Coccothrinax sabana, after the island. He was not yet satisfied, however. One did not come to an island once in a lifetime without looking it over thoroughly. He had to see what was growing on the rim, high above the spotless Dutch village. So he climbed to it and walked its four-mile circumference of outcroppings, along narrow ledges often skirting sheer drops of hundreds of feet. And there he found another palm, one he hadn't expected. It, too, proved to be a new species. He named it Prestoea sabana. What a triumph that day was for him!

The rest of the month was equally rewarding. The "Blue Peter" returned him to St. Martin, and later took him to St. Eustatius and to St. Kitts. From there he flew to Trinidad, thence to British Guiana, back to Tobago, on to Barbados, and to Grenada, stopping at each island for specimens of particular palms. On Richmond Hill, near St. George's in Grenada, Bailey took a specimen of another palm that later proved to be unnamed. He published an account of it in 1949, naming it Acrocomia grenadana.

When Bailey flew to St. Lucia a few days later, he set out for Barre de l'Isle, a nearby spit of land whose rich volcanic soil nurtures a dense rain forest. There, among the understory growth, he found another new palm, a dwarf, which he later named Aiphanes luciana.

His ninety-first birthday, in 1949, Bailey spent en route by sloop from St. Eustatius to St. Kitts. He had been in the Caribbean on that trip since the end of January, at Puerto Rico, at St. Thomas and St. Croix in the Virgin Islands, and at Antigua. He made only 23 collections on this trip. His constitution was beginning to deteriorate, was becoming incapable of meeting the demands he would make on it. The one specimen he took on Antigua, on February 25, turned out to be another new palm, Acrocomia antiguana. After a short stay at St. Kitts and at St. Eustatius, he came back to Antigua to do some collecting at St. John's. While there, he had an unexpected acute attack of asthma which forced him to rest under medical care, though not for long.

Eight days later he was on the other side of Antigua, taking a few last specimens before flying to Puerto Rico, and thence home. He had a second and more severe asthmatic attack on the plane on the last leg of the return trip, and was hospitalized immediately on landing at Boston. (Bad weather had closed New York airports.) Released the next morning, he went to New York by train, still a sick man. There a Hortorium colleague met him and accompanied him to Ithaca.

Soon Liberty Hyde Bailey was at work with the new specimens, studying, comparing, and writing about them. In the next few months he wrote accounts for Gentes Herbarum, reporting the findings of his two most recent trips. These were his last collecting expeditions, although he was still planning one final trip and even bought the ticket that was to take him to the Belgian Congo to study the oil palms. He never made it. Mind and body revolted against the still-ambitious spirit.

These Caribbean adventures had brought many rewards for Bailey: full herbarium cases, excellent photographic records, valued publications, world renown as a student of the American palms, and countless vivid memories. Nevertheless, he had not yet fulfilled his plans, for the promise of the future and the work he yet would do continued to be foremost in his mind. He wanted to master all the palms, to produce an opus about them that he would title "Genera Palmarum." A manuscript of the first page of the Introduction for it, written after he was denied the trip to Africa, is evidence of his unflagging determination. It is a work that will yet be written and towards which his Caribbean expeditions and studies will contribute much.

Outline of L. H. Bailey's travels in the Caribbean islands.

1910 (Feb.-Mar.) Jamaica, Cuba (en route from Panama to New Orleans).
1912 (Sept. 1-27) Lesser Antilles: St. Kitts, Antigua, Guadaloupe, Dominica, Grenada.
1920-1921 (Dec.-May) Puerto Rico (en route to Venezuela and Trinidad).
1922 (Jan.-Apr.) Bermuda, Barbados, Dominica, St. Kitts, Antigua, St. Lucia, St. Vincent, Grenada.
1923-24 (Dec.-Apr.) Barbados.
1929 (Feb.-Mar.) Cuba.
1931 (Feb.-Mar.) Jamaica, Cuba.
1931 (June-Aug.) Jamaica.
1932 (May) Puerto Rico.
1935 (Nov.-Dec.) Jamaica.
1937 (Mar.-Apr.) Haiti, Santo Domingo.
1937 (Nov.) Bahamas, Cuba.
1938 (Mar.) Cuba.
1938 (Nov.) St. Thomas, Guadaloupe, Martinique.
1939 (July-Aug.) Puerto Rico, Haiti, Santo Domingo.
1946 (Jan.-Mar.) Trinidad, Jamaica, Tobago.
1946-47 (Oct.-Jan.) Haiti, Jamaica, St. Kitts, Nevis, Antigua.
1948 (Jan.-Apr.) Lesser Antilles, Jamaica, Barbados.
1949 (Jan.-Apr.) Lesser Antilles, Bermuda, Puerto Rico, Virgin Islands, Antigua, Tortola.

HERMODACTYLUS, THE SNAKE'S-HEAD IRIS

The snake's-head iris is a delightful rarity to add to the perennial border, for it is one of the early spring flowers blooming in Ithaca in mid-April, and its blossoms are unusual in color - a combination of pea-green and dark plum-purple. The species is hardy at Ithaca without protection, although its persistent evergreen leaves do show winter burning at the ends.

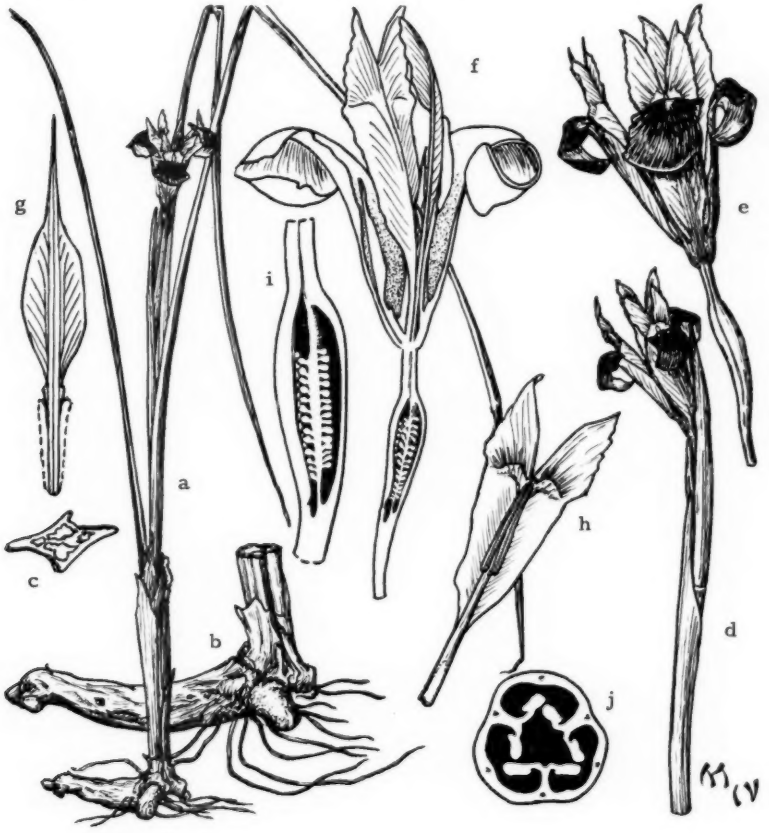

Fig. 15. Hermodactylus tuberosus: a, habit x 1/3; b, tuber x 4/5; c, cross-section of leaf x 3; d, inflorescence x 1/2; e, flower x 4/5; f, flower in vertical section x 1; g, standard (petal) x 2; h, underside of style-branch and stamen x 1; i, ovary, vertical section, x 2; j, ovary, cross-section, x 3.

This plant comes from the eastern Mediterranean region and spreads from the Alpes-Maritimes of France, from Corsica, Italy, and Greece, southeastward into the Arabian peninsula, and south along the eastern shores of North Africa. It occurs on open rocky hills, usually in dry to semi-arid areas of somewhat alkaline well-drained soils that are sun-baked during the summer months. For two centuries or more it has been naturalized in a few areas of Cornwall and Devon in the south of England, and in County Cork, Ireland.

It was known in the mid-1700's to Linnaeus, who considered it to be a species of Iris and named it Iris tuberosa. Nearly a century earlier, however, the French botanist Tournefort had recognized it as a genus distinct from Iris, calling it Hermodactylus (from the Greek, meaning Herme's fingers, in allusion to the arrangement and form of the tubers). Philip Miller also held it to be distinct, and in 1768 transferred it from Iris to Hermodactylus and renamed it Hermodactylus tuberosus.

The flowers of the snake's-head iris are certainly iris-like, but the plant differs from true irises in the character of its rootstock and ovary. The rootstock consists of 2-4 smooth finger-like tubers, while the ovary has a single chamber into which project three ovule-bearing placentae as shown in fig. 15j. In Iris there are three chambers in the ovary, each with a single ovule-bearing placenta.

The plant is clump-forming and the tubers should be divided every 3-4 years at the time the old foliage dies down. In its typical form, the flowering stem is about 3 dm. tall with its slender, glaucous, grass-like leaves being 3-6 dm. long. The flowers are about 4 cm. long with very dark (almost black) plum-purple velvety beardless falls and smooth pea-green standards and style branches. The standards (inner perianth segments) are very short, visible only when the flower is forced open, and then seen to be standing about 1 cm. high inside the falls and alternating with them (fig. 15g). The more showy green-colored parts of the flower are the three large forked style branches (fig. 15h). Beneath each of these stands one of the flower's three stamens. The leaves, like those of Iris reticulata, are quadrangular in cross-section (fig. 15c).

In southern Italy there occurs an endemic form known as var. longifolius (Sweet) Fiori [H. longifolius Sweet], which has leaves 9-12 dm. long. It is not known to be grown here although it was described in Bailey's Standard Cyclopedia of Horticulture, where Salisbury was cited incorrectly as the author of the binomial. It should read Hermodactylus tuberosus (L.) Miller.

Domestically, tubers are available from: P. de Jager & Sons, Inc., South Hamilton, Mass.; Walter Marx Gdns., Boring, Ore.; Oakhurst Gdns., Arcadia, Calif.; Pearce Seed Co., Moorestown, N.J.; Wayside Gdns., Mentor, Ohio.

G. H. M. Lawrence

The Influence of Liberty Hyde Bailey on Botany[1]

Philip A. Munz
Director
Rancho Santa Ana Botanical Garden
Claremont, California

Mr. Chairman, ladies and gentlemen, it is a special pleasure to me to be here today after being away from Ithaca for twelve years, and to see the progress made by the Bailey Hortorium during that time. I am of course delighted to participate in any occasion honoring Liberty Hyde Bailey. This one is very real to me since this week is the centennial also of my own father's birthday.

It was a great privilege for me to spend two years on the Hortorium staff from 1944 to 1946 and to come to know Dr. Bailey more intimately than I had earlier. As a graduate student at Cornell, I had admired him; as a professor at Pomona College I had had visits from him, because the farther away one lived from Ithaca, the more apt one was to see this world traveller. But to be with him daily for months at a time was a great experience.

I am to try today to sum up in these few minutes Bailey's influence on botany. First, let me say that in my two years here I discovered what a vast knowledge of plants Dr. Bailey had. When specimens came in for identification that were imperfect or broken and the rest of us had little or no idea what they might be, he almost always had a hunch. His knowledge covered families of Old and New Worlds, of Northern and Southern Hemispheres. His outlook was not that of a man interested primarily in a local flora, as is so often the case with American botanists. Preparation of works like the Standard Cyclopedia of Horticulture and the Manual of Cultivated Plants brought him into contact with innumerable taxonomic groups. While these had to be written largely by way of compilation, the authorship of studies of revisional or monographic nature on groups like Carex, Rubus, Cucurbita, Vitis, and various palms was based on more original work. This included field studies, some locally in the eastern United States, others farther afield. In fact, there are few botanists who travelled more widely than did Dr. Bailey in the course of his long life. His investigations took him through most of the United States and Mexico into the West Indies, Panama, Venezuela, Colombia, British Guiana, Brazil, China, New Zealand, and various Pacific islands. Earlier he had spent considerable time in Europe. In other words, he knew at first hand plants of many regions and climates and he knew them also in the herbarium and in botanical literature.

[1] An address delivered at Cornell University, March 14, 1958, on the occasion of the celebration of the Liberty Hyde Bailey Centennial.

I should mention too another source of Bailey's great knowledge and that was his life-long habit of growing plants and coming to know them as living things. This type of program began early, as witnessed by his little book entitled Cross-Breeding and Hybridizing, published in April, 1892. To be sure, he was at that time interested in carrying on experiments on some horticultural material which does not fall into the scope of my present remarks, but when he wrote, "A dozen fruits were selected from various parts of this patch, and in 1891 about 2500 plants were grown from them," it is obvious that he had early acquired the habit of raising plants. For many years it was his practice to go through seed catalogues, foreign and domestic, and to order seeds of forms with names that were new to him. These he grew and from them he made herbarium specimens. Some of these were horticultural forms, some were straight species. In all cases they taught him something. He came to feel that species differ among themselves physiologically and internally as well as morphologically, and often the former differences are very important.

My first point, then, is to emphasize the breadth and depth of Dr. Bailey's knowledge of plants, their variation, their classification, their distribution, and their behavior. Let us now look into his methods of work. His first major contributions to botanical science lay in his studies of the genus Carex. Here he did considerable field work and amassed what is still a notable herbarium for that genus, but he was one of the first men who seemed to be forming what we now call the type concept. As early as 1888, he studied type specimens of Carex in European herbaria and in 1889 he published a paper entitled "Studies of the Types of Various Species of the Genus Carex" (Mem. Torrey Bot. Club 1: 1-85). This is about as far back as I have been able to trace the development of this important concept.

In other nomenclatorial ways too, Dr. Bailey played a pioneer role. He was chairman of the committee appointed at one of the meetings of the Botanical Club of the American Association for the Advancement of Science to organize the group that became the Botanical Society of America. He participated in the discussions and committees of this society through which ultimately came the two codes of nomenclature that, interacting with the European formulations, have led to our modern rules. And of course he stands out as a creator of a terminology to be used in designating various domesticated forms and categories. What I am trying in part to say is that, always an active man, Liberty Hyde Bailey played a role in the development of botanical thought for many years. Those years covered the period when taxonomic methods were becoming more precise and when the whole concept of the species and other taxa was changing and developing. The influence of genetics and cytology was gradually coming in; with his interest in variation and hybridization, Dr. Bailey was ready for this impact. With his own

experimental studies he could understand its significance. As taxonomic thought developed during the first quarter of this century, Bailey was one of the prime movers in this country who helped to shape this thought.

And of course he was above all the man who pointed out over and over again that cultivated plants needed taxonomic study as did wild ones. No less an authority than Asa Gray, with whom Bailey worked as a young man and who certainly dominated the field of systematic botany in this country during that period, felt that many domesticated groups were too complex for satisfactory taxonomic treatment. But Bailey argued through many years that cultivated plants need to be admitted into the society of recognized species. He wrote (Science 21: 532-535, 1905): "The old-time distinction between native forms and domestic forms is arbitrary, unnecessary, and pernicious. All animals are animals and all plants are plants." As a pioneer in this field it was a satisfaction to him in his later years to see modern experimental methods applied in studies like those of Anderson on maize and of Heiser on peppers. In general, then, we can sum this all up by saying that Dr. Bailey made a great contribution to systematic botany, both of wild and of cultivated plants, not only by his own monographic writings, but in helping to develop the concepts of the time through which he lived and in extending these concepts beyond those of many of his contemporaries.

His early more strictly botanical work on Carex, which covered a period of almost two decades, was followed by a busy interim of teaching and administration and of writing, largely in horticultural fields. It was only after his retirement as dean of the College of Agriculture at Cornell to the honorary title of dean of American horticulture that he was again able to turn to more strictly botanical writing. Meanwhile his cyclopedias and other important works like various textbooks had appeared. This new period of travel and study was to last to the end of his life and was to center about a number of groups like the grapes and melons on the one hand, but particularly the brambles and palms on the other. Brief mention should be made of these latter groups. His work on North American species of Rubus was published as a series of papers in Gentes Herbarum. Whatever the final outcome of genetical and cytological researches on this genus may be, we can point out that Bailey has made us aware of its great complexity. He has given us a detailed and accurate discussion of the material available to him and has illustrated and presented his discussion in such a way that subsequent workers may know what he was writing about. He has amassed the first herbarium collection of adequate specimens for study.

His work on palms has amazed me. Accomplished largely after he was an octogenerian and by his own field efforts after, as he put it, he had to travel alone because his daughter had become too old to go along, it is a real monument. He published over 1100 pages

on the palms with an additional 113 pages in collaboration with Dr. H. E. Moore, Jr. He brought together at Ithaca a collection of material, photographic and botanical, which to a layman in the group like myself seemed most significant. For each species that he studied he tried to get as complete a representation as possible. Earlier herbarium specimens of palms are often so inadequate as to be quite impossible for satisfactory understanding of the plants involved. I remember how Dr. Bailey returned in the spring of 1946 from some months in Trinidad and Tobago with notes and photographs and specimens of leaves, flowers, and fruits giving quite complete pictures of the palms of those islands. Then he showed me illustrations in the books on Brazilian palms bearing the names which had been used for the plants from Trinidad. Even a novice could see how different they were and it was not surprising to me, when Dr. Bailey's paper appeared in 1947, to see many new species proposed in it. For a man almost ninety to obtain this material in the field, to work it out, and to present a beautifully illustrated and beautifully written treatise was no mean accomplishment.

There is not time today to attempt to evaluate Dr. Bailey's contributions to plant science through his textbooks which covered many fields of botany, plant breeding, and horticulture. Nor can I mention in any detail the encyclopedic works and manuals, which again are both botanical and horticultural in import. But their influence has been great. The Standard Cyclopedia of Horticulture has been translated into a number of foreign languages, so that it has had world wide importance.

In the same way it is impossible to indicate the Bailey influence as a teacher. I do know that when I was on the Hortorium staff, I often heard him speak of one rather elderly man after another, each prominent in some phase of plant science, as his former pupil. The elderly part is not surprising when we remember that Dr. Bailey's main teaching career ended about 1903 when he became dean. Suffice then to say that he must have been a great teacher with considerable influence through his activity as a teacher.

I might sum up briefly the various ways in which Dr. Bailey left his influence on botany as follows:

He was a distinguished systematist, making great contributions to our understanding of various groups of plants, like Carex, palms, Rubus, Vitis, Cucurbita, etc., as well as of certain cultivated groups like the cabbages and plantain-lilies.

He edited and did no small part of the writing of a series of encyclopedic works and manuals which, while dealing primarily with ornamentals and other cultivated plants, are in many plant groups and for many persons the chief means by which many identifications can be made.

He led the way in America in helping to break the prejudice against the taxonomic study of domesticated plants and showed that they need to be studied with many of the same techniques and methods as do other plants.

He was in the vanguard in establishing better rules of nomenclature, having been one of the first to use the type concept and to propose special terms for designation of forms originating in the garden.

He was a great teacher and administrator and in both categories did much for development of botanical sciences in the widest sense.

He built up a private herbarium and library in which horticultural as well as more strictly botanical materials are assembled. With these collections as a basis was established the Bailey Hortorium, where botanical and horticultural activity are happily combined and where for long years to come the Bailey influence on botany will continue.

"The Observer's Book of Cacti and Other Succulents" by S. H. Scott. 159 pp., with 16 color plates, 48 photographs in black-and-white, and 6 line figures. Frederick Warne & Co., New York and London. 1957. Price $1.25.

This little handbook, for those interested in collecting and growing cacti and other succulent plants, is small, a manual in the true sense of the word (pages measure only 3 1/2 × 5 1/2 inches), but it is packed with concise information. This includes brief descriptions of over 300 selected species, together with cultural directions. Though the latter are for plants grown under glass in the British Isles, they are easily adaptable to conditions elsewhere. The book is well illustrated, the color plates being especially attractive (but the plant in plate 35 does not appear to be Rhipsalis [Hariota or Hatiora] salicornioides, as it is labelled).

The nomenclature used is a "standard" horticultural one - a few names, though long-familiar, are no longer acceptable to the taxonomist: e.g., the Christmas cactus is, correctly, Schlumbergera Bridgesii, not Zygocactus truncatus; Euphorbia splendens = E. Milii, etc.). The text seems to have had careful editing, except for inconsistency in capitalizing specific epithets derived from proper names and one or two similar minor lapses. All in all, though, considering the store of information in the text, the many good illustrations, and the low price, this is a genuine bargain.

W. J. D.

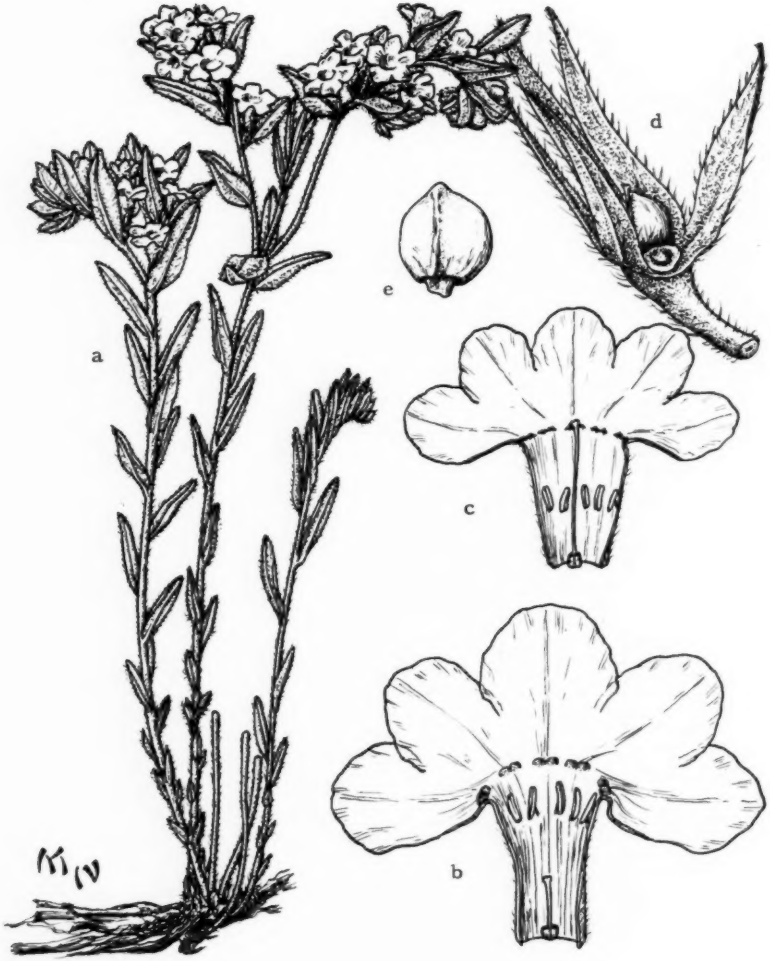

Fig. 16. Lithospermum canescens: a, habit x .3/5; b, corolla of a short-styled fl., expanded, x 3; c, corolla of a long-styled fl., expanded, x 3; d, fruit in which only 2 nutlets have matured x 3; e, nutlet x 4.

Studies in the Cultivated Boraginaceae
1. Lithospermum and Related Genera

John Ingram

The Boraginaceae are a medium-sized family of cosmopolitan distribution, having indigenous members on all continents. One of its areas of greatest development is western North America.

The genus Lithospermum was one of the original fourteen boraginaceous genera known to Linnaeus; he described six species in his Species Plantarum, ed. 1, 132-133, 1753. As new species resembling Lithospermum were discovered, many of them were assigned to it until its generic limits were so expanded as to render it a catch-all for plants that would eventually be segregated into smaller, more coherent genera.

Lithospermums have been in cultivation for many years. The eighth edition of Miller's Gardeners Dictionary, 1768, listed five species of Lithospermum. Two of these, Lithospermum purpureo-caeruleum (now referred to Buglossoides) and L. fruticosum (Lithodora), are still in cultivation. These two species were named by Linnaeus, but L. fruticosum was transferred to Lithodora in 1846, and L. purpureo-caeruleum to Buglossoides in 1954. A name that has been used for 200 years by gardeners and botanists is not quickly abandoned for another, especially when the new name is difficult to pronounce or is as unaesthetic-sounding as Buglossoides.

Even though it is commonly known that many large genera contain numerous discordant elements that would better be segregated into more homogeneous groups, many conservative people tend to resist this change and plants continue to be known by an incorrect or discarded botanical name. Some of these revisions may appear to be trivial, but when these regroupings of genera are made by students who have a thorough knowledge of the whole family and their conclusions are supported by evidence assembled by their investigations, then it is best to consider their findings before hastily rejecting their opinions.

Dr. I. M. Johnston, a well-known student of the Boraginaceae, has recently restudied the tribe Lithospermeae to which the genera considered in this paper belong. Some of these genera had not had critical study for almost a century. He has extensively restudied the morphology of corollas and nutlets, which are the traditional plant parts used in the classification of the family, and added to this other evidence from the study of the pollen. His efforts have brought about a redefinition of some of these genera; it therefore is important that the cultivated species involved be correlated with these findings, since every species mentioned has, at one time, been cultivated as Lithospermum.

The four genera under discussion are Buglossoides, Lithodora, Lithospermum, and Moltkia. Since they belong to the same tribe, they have certain features in common. They are mostly herbaceous perennials or subshrubs, and, in keeping with most members of the family, have abundant hairs on the vegetative and many of the reproductive structures. In the brief descriptions given for the included genera, I have mentioned the term "heterostyly." This condition occurs in various families of flowering plants, and means that the individual plants of a particular species produce either flowers that have long styles with the stamens low in the corolla-tube, or flowers with short styles with the stamens high in the corolla-tube (fig.16b, c). The size of anthers and the size and form of corollas of heterstylic flowers sometimes vary between the short and long-styled flowers. The fruit is typical for the family in that it is composed of 1-4 nutlets. The morphology of the nutlets is important in the classification of the Boraginaceae, so they have been illustrated for each genus to help in understanding the key when special reference is made to them.

Key to Genera

1. Corolla purple, blue, blue with a white eye, or if completely white, the throat not crested (an uncultivated species, Moltkia aurea Boissier, has yellow flowers).
   2. Corolla-throat glabrous inside, or, if hairy or glandular, the hairs and glands localized or scattered but not arranged in vertical lines.
      3. Inflorescence with 1-10 flowers, never coiled; nutlets erect, circumscissle above the base, falling away and leaving the short basal portion persisting as a cup-shaped appendage (fig. 17). . . . . Lithodora
      3. Inflorescence with many flowers, coiled; nutlets evidently bent at or near the middle, with basal dehiscence (fig. 18). . . . . Moltkia
   2. Corolla-throat bearing inside 5 well-developed vertical lines of stipitate glands or hairs, or 5 hairy and glandular inflexed plaits (fig. 19). . . . . Buglossoides
1. Corolla yellow, orange, white with a yellow eye, or, if completely white, the throat prominently crested (fig. 20) (an uncultivated species, L. Hancockiana Oliver has bluish to purplish flowers). . . . . Lithospermum

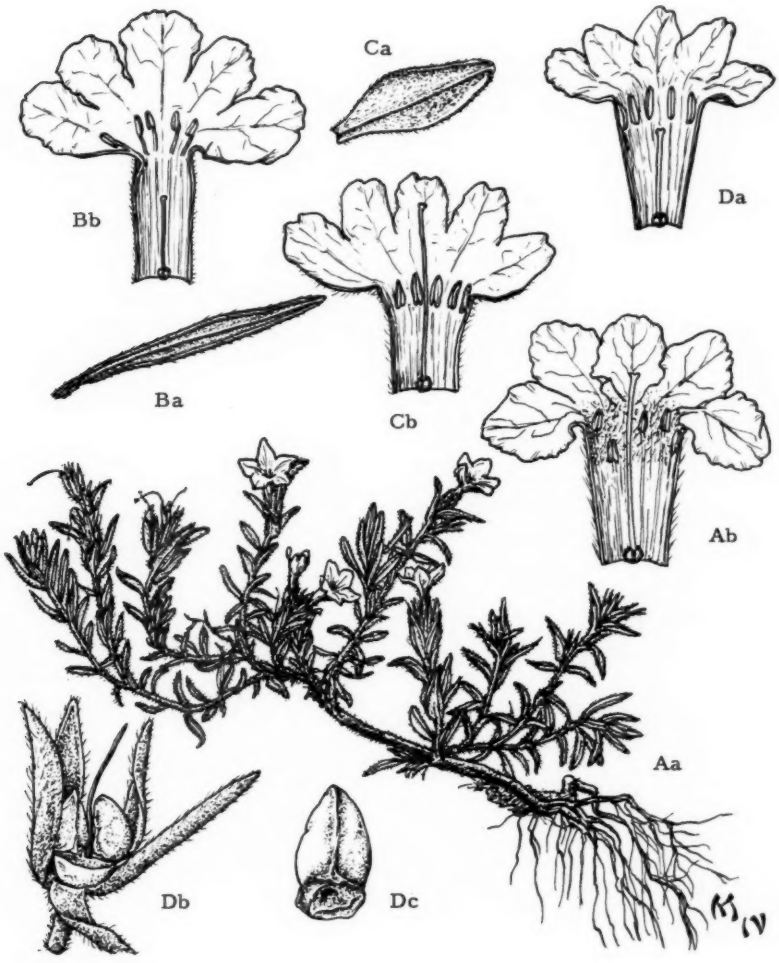

Fig. 17. A, Lithodora diffusa: a, habit x 4/5; b, corolla expanded x 2. B, Lithodora rosmarinifolia: a, leaf x 1; b, corolla of a short-styled fl., expanded, x 2. C, Lithodora oleifolia: a, leaf x 1; b, corolla of a long-styled fl., expanded, x 2. D, Lithodora fruticosa: a, corolla of a short-styled fl., expanded, x 2; b, fruit, in which 2 (of 4) nutlets have matured x 3; c, mature nutlet x 5.

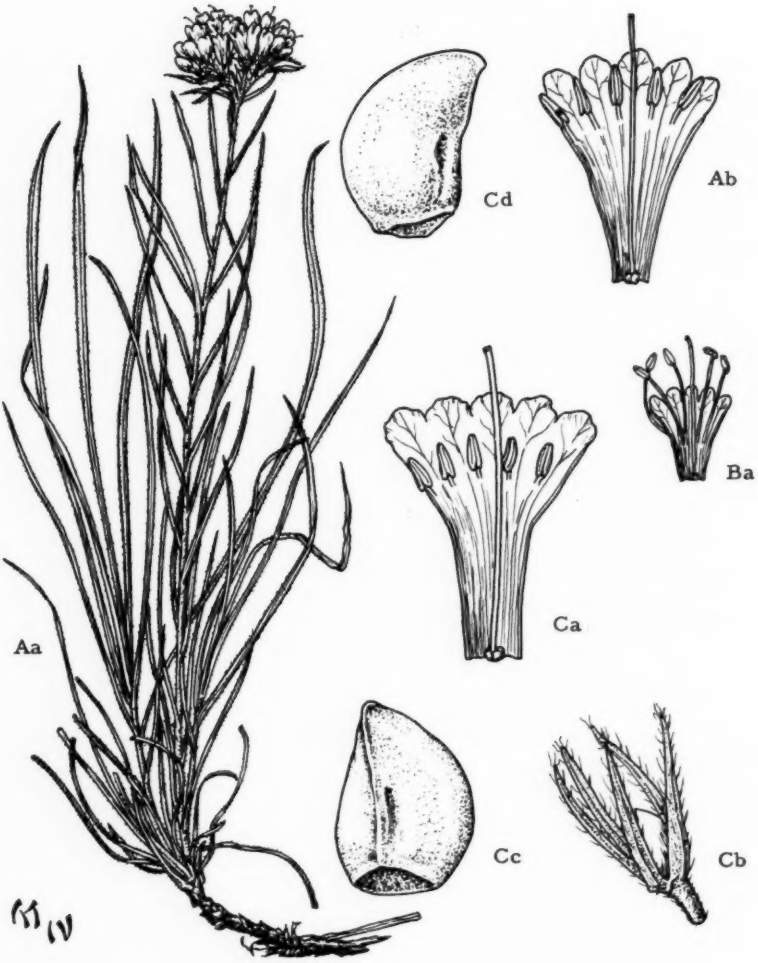

Fig. 18. A, Moltkia suffruticosa: a, habit x 1/2; b, corolla expanded x 2. B, Moltkia petraea: a, corolla expanded x 2. C, Moltkia Doerfleri: a, corolla expanded x 2; b, fruit, in which only 1 nutlet has matured, x 3; c, d, nutlet x 8.

LITHODORA Grisebach, Spicilegium Florae Rumelicae et Bithynicae ... 2: 85, 1844; Johnston, Journal of the Arnold Arboretum 34: 259-268, 1953.

A genus of seven species of low shrubs and subshrubs of cliffs and exposed rocky areas of western and southern Europe, northern Africa, and Asia Minor. The flowers are arranged in short, lax cymes bearing one to ten flowers; the inflorescence is never coiled. The corollas are blue or purple and are funnelform in shape. Heterostyly is present in five of the seven species (fig. 17). The distinctive feature of the genus is the matter of the circumscissle dehiscence of the nutlets, a condition which is unique in the family. Commonly only one nutlet matures, and at maturity it dehisces leaving a small portion of the nutlet attached to the gynobase, in the form of a cup- or saucer-shaped appendage.

Key to the Cultivated Species of Lithodora

1. Corolla glabrous on the outside (fig. 17Da). . . . . .L. fruticosa
1. Corolla hairy on the outside.
   2. Stamens affixed at unequal levels in the corolla-tube (fig. 17Ab); nutlets striate (with fine longitudinal lines). . . . . .L. diffusa
   2. Stamens all affixed at the same level in the corolla-tube, either at the top of the tube, or at the base; nutlets smooth.
      3. Prostrate subshrub to 30 cm. high; leaves oblong to elliptic-oblong, the margin not revolute (fig. 17Ca) . . . . . .L. oleifolia[1]
      3. Erect, tufted shrub to 60 cm. high; leaves linear-lanceolate, the margin revolute (fig. 17Ba) . . . . . .L. rosmarinifolia

MOLTKIA Lehmann, Neue Schriften Naturforschende Gesellschaft zu Halle 3(2): 3, 1817; Johnston, Journal of the Arnold Arboretum 34: 268-275, 1953.

A genus of six species of herbaceous perennials or subshrubs native to southern Europe and the Near East. The flowers are borne in several-flowered, one-sided, elongated cymes. One uncultivated species has yellow flowers; the other species, however, all have blue or purple flowers. The corollas are glabrous on their outer surfaces, whereas most of the species of the other genera considered here have corollas with the outside hairy. Heterostyly does not occur. The nutlets are either smooth and lustrous or rough and opaque; however, they are evidently bent at or near the middle and have a basal dehiscence.

[1] Although the original spelling of the specific epithet was oleaefolia, and though it is still to be found spelled thus in much of the botanical and horticultural literature, the correct spelling, under the present rules of nomenclature, is oleifolia (see Article 73: Note 2 and Examples of orthographic errors; also, Recommendation 73G). Briefly, the rules state that "the original spelling of a name or epithet must be retained, except that...orthographic errors should be corrected....The use of a wrong connecting vowel or vowels...is treated as an orthographic error....In a true compound [name]...a noun or adjective in a non-final position appears as a bare stem without case-ending....Before a consonant...in Latin the final vowel is reduced to i." The examples "menthifolius, salviifolius" given for the last instruction are homologous with "oleifolius."

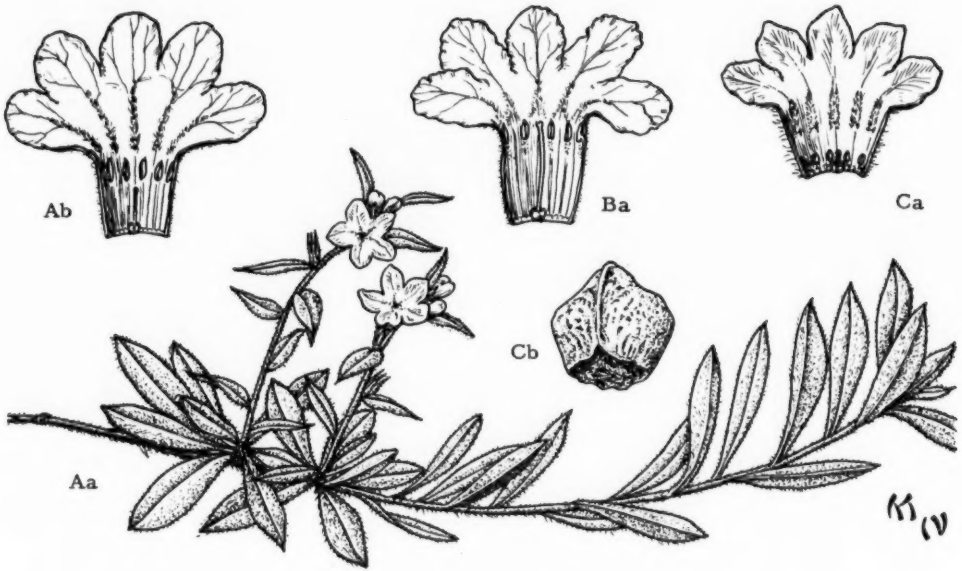

Fig. 19. A, Buglossoides Zollingeri: a, habit x 4/5; b, corolla expanded x 2. B, Buglossoides purpureo-caeruleum: a, corolla expanded x 2. C, Buglossoides Gastonii: a, corolla expanded x 2; b, nutlet x 4.

Key to the Cultivated Species of Moltkia

1. Plants herbaceous perennials, stems from a perennial rhizome; flowers about 2.5 cm. long (fig. 18Ca) . . . . . .M. Doerfleri

1. Plants shrubs or subshrubs; flowers about 13 mm. long.

   2. Anthers blue, exserted well beyond the corolla-lobes (fig. 18Ba); leaves 1-5 cm. long. . . . . .M. petraea[1]

   2. Anthers yellow, not or scarcely exserted beyond the corolla-lobes (fig. 18Ab); leaves 5-15 cm. long. . . . . .M. suffruticosa[1]

BUGLOSSOIDES Moench, Methodus Plantas ... describendi p. 418, 1794; Johnston, Journal of the Arnold Arboretum 35: 38-46, 1954.

A genus of about seven species of annuals, biennials, herbaceous perennials, and subshrubs native to Asia, southern Europe, and northern Africa. The genus is distinguished readily from Lithospermum by the usually blue or purple corollas with their five vertical plaits or lines of hairs and glands. This arrangement of plaits and hairs within the corolla is unique to Buglossoides. Heterostyly does not occur, and at maturity the style is never more than half the length of the mature nutlets. In the cultivated species, the nutlets are smooth and lustrous or rough and frequently only one develops.

Although Buglossoides arvense (Linnaeus) Johnston (Lithospermum arvense Linnaeus) is not cultivated, it is a fairly common weed of sandy fields, roadsides, and gardens. It is naturalized in eastern North America and sparingly in northwestern United States, probably having been introduced with cereals.

[1] Fertile hybrids between Moltkia suffruticosa and M. petraea are known and these may key out to either of the parents, though they will generally be somewhat intermediate in character between the two. Two slightly different such hybrids have been described under the names of Lithospermum × intermedium Froebel and L. × Froebelii Sündermann, in Allgemeine Botanische Zeitschrift 12: 92, 1906. The name Lithospermum × intermedium was published in a nursery catalogue sent out by Otto Froebel of Zurich, Switzerland. It appears in Katalog No. 120, 1896, but may possibly have been published in an even earlier catalogue which I have not seen. As far as I have been able to discover, these epithets have not been formally transferred to Moltkia, although the names Moltkia × intermedia and M. × Froebelii have appeared in horticultural literature. Since both the International Code of Botanical Nomenclature and the International Code of Nomenclature for Cultivated Plants state that where binary "specific" names of Latin form are used for hybrids, all offspring of crosses between individuals of the same parent species receive the same binary name, the correct name under Moltkia must be Moltkia × intermedia since Lithospermum × intermedium is the older name and must be considered the basionym. However, because the plants known under the two previous names differ somewhat, they can be distinguished nomenclaturally by treating them as cultivars of the one hybrid: i.e., Moltkia × intermedia cv. 'Intermedia' and Moltkia × intermedia cv. 'Froebelii'.

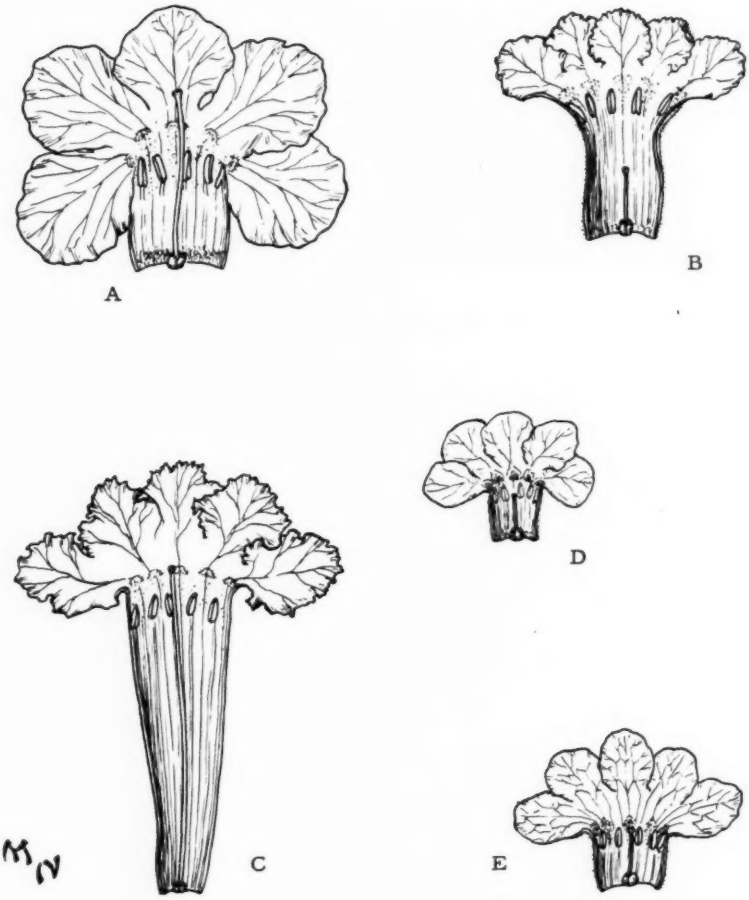

Fig. 20. A, Lithospermum caroliniense, corolla of a long-styled fl. expanded x 2. B, L. multiflorum, corolla of a short-styled fl. expanded x 2. C, L. incisum, corolla expanded x 2. D, L. distichum, corolla expanded x 2. E, L. ruderale, corolla expanded x 2.

Key to the Cultivated Species of Buglossoides

1. Flowers dark blue with white centers; anthers about as long as their filaments (fig. 19Ca); nutlets rugulose (finely wrinkled), yellowish. . . . B. Gastonii

1. Flowers purple or blue; anthers more than twice as long as their filaments (fig. 19Ab); nutlets smooth, white.

   2. Flowering stems 30-60 cm. long, from a densely branched rhizome; leaves lanceolate; flowers in a pair of terminal cymes. . . . . B. purpureo-caeruleum

   2. Flowering stems 10-23 cm. long, from procumbent stems persisting from the previous season; leaves oval to oblanceolate; flowers in unbranched terminal cymes. . . . . B. Zollingeri

LITHOSPERMUM Linnaeus, Species Plantarum, ed. 1, 132-133, 1753, and Genera Plantarum, ed. 5, 64, 1754; Johnston, Journal of the Arnold Arboretum 35: 59-65, 1954. (Synonym: Batschia G. F. Gmelin, Systema Naturae ... 2: 315, 1791.) Gromwell, puccoon.

The genus is semicosmopolitan and is represented on all continents except Australia. It comprises about forty-four species of mostly herbaceous perennials with only a few annual, biennial, or fruticose species. All species commonly have roots containing a purple- or red-staining dye. The flowers are usually in helicoid cymes, and are mostly yellow to orange, sometimes white; however, one uncultivated Chinese species has bluish to red-purple flowers. The corollas are salverform, funnelform, or cylindric, bearing small invaginated glanduliferous or pubescent appendages (fig. 20a), or localized areas with glands or hairs (fig. 20b) in the corolla-throat. Some species are heterostylic (fig. 16b, c), and L. incisum is mentioned in the key as having two kinds of flowers. Flowers mentioned as the later ones are cleistogamous, which means they are small, less showy, remain closed, and therefore are self-fertilized. The nutlets are very distinctive in that they are usually white, shining, and porcelain-like.

Key to the Cultivated Species of Lithospermum

1. The corolla-throat bearing prominent crests.

   2. Flowers yellow or yellow-orange.

      3. Flowers all uniform in size, the corolla-lobes entire or subentire.

         4. Plants hispid or hirsute; calyx-lobes hispid; corolla hairy inside at the base (fig. 20A) . . . . . L. caroliniense

         4. Plants hoary; calyx-lobes with soft, appressed hairs; corolla glabrous inside at the base (fig. 16b) . . . . . L. canescens

      3. Flowers of two kinds, the earlier ones to 3.5 cm. long, with fimbriate corolla-lobes, the later ones smaller (fig. 20C) . . . . L. incisum

   2. Flowers white or white with yellow crests (fig. 20D) . . . . . L. distichum

1. The corolla-throat lacking crests.

   5. Flowers greenish-yellow; corolla-tube about the same length as the calyx, the corolla-lobes entire, longer than wide (fig. 20E) . . . L. ruderale

   5. Flowers yellow to orange; corolla-tube about twice as long as the calyx, subentire, about as long as wide (fig. 20B) . . . . . L. multiflorum

The following is a finding list of species names in Buglossoides, Lithodora, Lithospermum and Moltkia. Valid names are underlined.

Batschia
canescens Michaux :: Lithospermum canescens

Buglossoides
Gastonii (Bentham) Johnston
purpureo-caeruleum (Linnaeus) Johnston
Zollingeri (A. de Candolle) Johnston

Lithodora
diffusa (Lagasca) Johnston
fruticosa (Linnaeus) Grisebach
oleifolia[1] (Lapeyrouse) Grisebach
prostrata (Loiseleur-Deslongchamps) Grisebach :: Lithodora diffusa
rosmarinifolia (Tenore) Johnston

Lithospermum
angustifolium Michaux :: Lithospermum incisum
canescens (Michaux) Lehmann
caroliniense (Walter) MacMillan
croceum Fernald :: Lithospermum caroliniense
diffusum Lagasca :: Lithodora diffusa
distichum Ortega
Doerfleri Hort. :: Moltkia Doerfleri
×Froebelii Sündermann :: Moltkia ×intermedia cv. 'Froebelii'
fruticosum Linnaeus :: Lithodora fruticosa
Gastonii Bentham :: Buglossoides Gastonii
Gmelinii (Michaux) Hitchcock :: Lithospermum caroliniense
graminifolium Viviani :: Moltkia suffruticosa
hirtum (Muhlenberg) Lehmann :: Lithospermum caroliniense
incisum Lehmann
×intermedium Froebel :: Moltkia ×intermedia
linearifolium Goldie :: Lithospermum incisum
mandanense Sprengel :: Lithospermum incisum
multiflorum Torrey in Gray
oleifolium Lapeyrouse :: Lithodora oleifolia[1]
petraea (Trattinick) de Candolle :: Moltkia petraea
prostratum Loiseleur-Deslongchamps :: Lithodora diffusa
purpurascens Gueldenstaedt :: Buglossoides purpureo-caeruleum
purpureo-caeruleum Linnaeus :: Buglossoides purpureo-caeruleum
rosmarinifolium Tenore :: Lithodora rosmarinifolia
ruderale Douglas ex Lehmann
Zollingeri Alphonse de Candolle :: Buglossoides Zollingeri

Moltkia
Doerfleri Wettstein
×Froebelii (Sündermann) Hort. :: Moltkia ×intermedia cv. 'Froebelii'
graminifolia (Viviani) Nyman :: Moltkia suffruticosa
×intermedia (Froebel) Ingram[2]
petraea (Trattinick) Grisebach
suffruticosa (Linnaeus) Brand

[1] See footnote 1, page 95.
[2] See footnote 1, page 97.

The Influence of Liberty Hyde Bailey on Horticulture[1]

George M. Darrow
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At this centennial of a great man, one of the great leaders of America, perhaps the most important question our world asks is, "What made him great?" What influenced a farm boy raised under pioneer conditions to become a great leader of men, a great teacher, writer, and editor? And more specifically, the questions horticulturists ask are: first, why did he choose horticulture as his major field of interest; second, how did he make horticulture, the art of gardening, into the science of horticulture; third, how can America produce more L. H. Baileys?

Of course, a geneticist must consider the genetic stock from which this man came. His Puritan father came from Townshend, Vermont, a tiny Green Mountain village, to which President W. H. Taft and other famous men trace their ancestors. It had been settled by good stock and it had a fine environment. The father graduated from Townshend Academy. He settled in what is now South Haven, in western Michigan, when about 22, clearing the virgin forest and becoming one of the first and foremost orchardists of that magnificent orchard region. The mother was Sarah Harrison, of the Virginia Harrison family from which came one of our Presidents. Thus, Bailey's heredity was good. But what made the good seedling great? There had to be rich soil for the good seedling.

The mother died before he was five. The Puritan father certainly had a large part in the son's development. The father was a charter member of the local South Haven and Casco Pomological Society and a leader in his community. He helped the son care for flowers and the son helped in all the work of the frontier orchard farm. Soon after the boy was 10, he was grafting fruit trees for his neighbors and he had an apple tree with 40 kinds grafted on it. He learned all phases of orchard and farm work by actual practice. The second book written by the son was inscribed "To my father, the results of whose teachings are embodied in these pages."

[1] An address delivered at Cornell University, March 14, 1958, on the occasion of the celebration of the Liberty Hyde Bailey Centennial.

A second major influence was a school teacher, Mrs. Julia Fields, who, when he was 10 or 12, had a natural history class with him as a single pupil. In addition to his daily book assignment, she asked him to report on things about which he had to find the answers in the fields and woods. She had pointed out to him that "This is a beautiful world but you don't really see any of it," and asked him such questions as "How many trees of a certain kind within a mile, how tall, how large, and what was their spread?" This certainly trained his powers of observation and made his nature study factual.

A third major influence was his reading, in his early teens, Darwin's On the Origin of Species and Gray's Field, Forest, and Garden Botany. Both books are normally books of older students but he seemed able to understand most of both these books, and he got help for what he did not understand.

A fourth major influence was Dr. Beal, Professor of Botany at Michigan State College, one of the early great teachers of botany. Other major influences were the discipline of college life in those days: mornings for classes, afternoons for manual labor; teaching country school during the 3-months winter recess from college; a few months of reporting on a Springfield, Ill., newspaper; and finally two years working with Asa Gray, the great botanist of Harvard. Throughout these years of training, his interest in horticulture was foremost, even though horticulture was considered an art, an avocation, mere practical gardening, not a science.

Thus, the botany student who had learned fruit growing at home, natural history at a country school, broad concepts of biology from his earliest reading, the relation of plants to human life from Dr. Beal at Michigan State, and the enormous number and classification of plants from both Dr. Beal and Dr. Gray, thought always of plants in relation to their use by man. He had learned to write clearly and forcefully and he was proud of farm people and of his farm origin. After his two years with Gray, he returned to Michigan State in 1885 as Professor of Horticulture and Landscape Gardening - the first position of its kind in the country. He not only organized his horticultural department work that first year, but had his first book published.

To make horticulture a science there must be text and reference books. The great volume of horticultural information needed to be systematized for teachers and students and the results of research made available. He started immediately on this work. Before he moved on to Cornell to become Professor of General and Experimental Horticulture in 1888, he had already planned and started some of these books. He wrote text books on fruit, vegetable, and flower growing; on plant breeding; and on nursery work. He also edited two cyclopedias of horticulture and wrote two manuals of

cultivated plants. It is recorded that he edited 117 books on agriculture by 99 different authors for the Macmillan Company. He became a master of compiling, writing, and editing books. But he went beyond teaching horticulture and writing and editing many of its text and reference books. He was a pioneer in the practice of experimental procedure in horticulture, working in 1890 on plant growth under electric lights, on the physiology of seed germination, and on the value of carbon dioxide in promoting growth of greenhouse plants. He did breeding work with grapes, cucurbits, and bramble fruits and he began his taxonomic work with cultivated plants. There was a large amount of scientific work in horticulture being done but no regular meetings of the research workers. To fill this gap he was one of the organizers of the American Society for Horticultural Science in 1903, a society "more fully to establish horticulture on a scientific basis." The Society now has over 2,000 members and has published 70 volumes of research papers.

These years - 1885 to 1888 at Michigan State College, and 1888 to 1903 at Cornell University, less than 20 altogether - were the years he gave to making horticulture a science. But Bailey was not content with changing horticulture from an art to a science wherein he integrated the disciplines of systematic botany, plant physiology, and plant breeding. He had a vision of the science of horticulture as a subject of major importance in the training of young people. It not only should have its text and reference books and its experimental procedures, but must have trained teachers of horticulture with a distinctive philosophy of life. A part of this training of teachers and this philosophy he developed during the years he taught horticulture. Much of it came later when, as Dean and Director of the New York College of Agriculture, he was more conscious of horticulture in relation to the entire field of agriculture and to the entire field of science.

Dean Bailey shared his love of inspirational literature with his students and at assembly and on Sunday evenings read from his own writings and from those of others. As a student at Cornell, I heard Bailey read "The Explorer" by Kipling in a manner which will always be remembered by all in that assembly:

> "There's no sense in going further - it's the edge of cultivation,"
> So they said, and I believed it - broke my land and sowed my crop -
> Built my barns and strung my fences in the little border station
> Tucked away below the foothills where the trails run out and stop:
>
> Till a voice, as bad as Conscience, rang interminable changes
> On one everlasting Whisper day and night repeated - so:
> "Something hidden. Go and find it. Go and look behind the Ranges -
> "Something lost behind the Ranges. Lost and waiting for you. Go!"

So I went, worn out of patience; never told my nearest neighbours -
Stole away with pack and ponies - left 'em drinking in the town;
And the faith that moveth mountains didn't seem to help my labours
As I faced the sheer main-ranges, whipping up and leading down.

- - - - - - - - -

But at last the country altered - White Man's country past disputing -
Rolling grass and open timber, with a hint of hills behind -
There I found me food and water, and I lay a week recruiting.
Got my strength and lost my nightmares. Then I entered on my find.

The pioneer in Bailey responded to this poem, it expressed what he felt and he could impress students with its meaning.

And I also recall his telling us what research was and was not. It was not planting an apple tree in one's back yard and then with rule and an air of mystery measuring and recording to the tenth of an inch its height each day throughout the growing season. Such a record would be meaningless. There must be comparisons between conditions or materials to be research.

It is no wonder that able young people were attracted to Cornell and to the study of horticulture. Here was a new specialized branch of botanical science that was based on systematic and physiological botany and that used all biological and physical sciences. It was respected; it had a wide field of usefulness; there were good text and reference books and able teachers. Bailey was proud of his students and of his science. His students were and still are dedicated people who believe in the science in which they work - in its usefulness to the world and in its subject matter. Through them he still lives.

Personally, I use his Cyclopedia of Horticulture and his Manual of Cultivated Plants most of all and frequently. They still are invaluable reference works to all in the field of horticulture. His monographic works on palms and on North American Rubus in Gentes Herbarum, and his Hortus, are perhaps next in value to horticulture. He began his study of Rubus as early as 1882 and published his monograph from 1941 to 1945. It is a reference work for the study of related forms and species and the history of each. I use it for the completeness of its coverage of American Rubi, and its accuracy, not for its interpretation of species. I have personally made many crosses of Rubi and have supervised extensive breeding work in this genus, but never can I nor all the breeders in the world equal the millions of crosses on wild plants made daily each spring by bees. The bees have not been trained to go to the flowers of one species only. They hybridize species and make millions of hybrids, backcrosses, and segregates yearly.

Though Bailey's memory was remarkable - he could be interrupted in dictation and after the lapse of days return to finish the

sentence or article with a full knowledge of what had been said - the forms or biotypes in Rubus are infinite and only by a knowledge of the cytogenetics of the genus and the effects of environment on gene expression can we hope to understand the group. I have, myself, seen the unstable hybrid ('Boysen' × 'Eldorado' [8n]) blackberry plant at the University of Maryland that produced 3 canes, each having a different chromosome number and each differing so greatly from the others that they might be classed as different species, even by the non-splitting systematist. Many other unstable Rubi have been studied at the University of Maryland.

Dr. Bailey himself suggested that many genera should be reworked after about 25 years as new information from research became available. However, Bailey has given us the broad outline and classification of the blackberries of North America which is of great value to those working with this extremely diverse group. Only by using all the results of breeding and cytogenetics can we evaluate and use the forms of Rubus which we find and which Dr. Bailey and others described for North America.

We have surveyed briefly the life and influence on horticulture of this son of a Vermont Puritan and of a Virginian of a fine family; who was brought up on a fruit farm in the virgin forest of western Michigan; who was influenced greatly by a country school teacher in wide and accurate observation of nature; who was trained in habits of industry; who was in contact with the finest minds of his time, in part through their books and in part by personal contacts; who was proud of his chosen field; who changed horticulture from gardening to a science; who wrote its early text books, its early reference books, its inspirational books; who trained its teachers; who established the scientific method as its basis and who helped to organize its scientific society. And we will honor him by trying, each according to his capacity, to further progress in horticultural science - by research, or teaching, or writing.

Fig. 21. Claude A. Barr.

Plantsmen in Profile, VI: Claude A. Barr

Mary H. Moon

The native flora of the Great Plains has an attraction for the rock gardener and the wild flower enthusiast, for the fragile beauty that thrives in that vast, wind-swept landscape has a precious quality that appeals to many. Many of these plants have been available to ardent gardeners through the energies of Claude Arno Barr of Prairie Gem Ranch, Smithwick, South Dakota, for he has been supplying them since 1932. To meet his customers' requests he has searched out the worthiest of the native kinds on his 1400 acre ranch, has collected them regularly in neighboring Wyoming and Nebraska, and has grown and propagated them in his scant acre garden. He had not originally intended that his interest in plants should become a source of livelihood. That happened by chance.

Claude Barr was born in Arkansas on August 27, 1887. He attended high school in St. Louis, Missouri, and then enrolled at Drake University, Des Moines, Iowa. While working at a summer job in eastern South Dakota in 1909, he heard that land in Fall River County was open for homesteading, and subsequently he and his father together filed claims on the land from which Prairie Gem Ranch later developed. After the many months it required to prove the claim, Claude Barr returned to his studies at college, and received a Bachelor of Arts degree in 1914. The following year he returned to the homestead, for the heavy soil and alkali water that made farming so difficult had discouraged his father and mother as well as their neighbors, many of the latter of whom had already abandoned their homesteads. For a number of years young Barr persisted in attempting to grow corn and alfalfa successfully on the unsuitable gumbo, but finally settled on cattle raising as the most practicable method of utilizing the stubborn land. It is now the principal business of Prairie Gem Ranch, and his herd of one hundred Herefords gives him great satisfaction, for he is fond of making pets of even the bulls.

It did not take long for Claude Barr to learn to know the plants that grew in his neighborhood. From the nearby Black Hills he brought western yellow pine to plant about his buildings, and under one of them he set a clump of the Pasque flower, Anemone patens, the state flower of his newly adopted state. For many years it

flourished and blossomed there. One of the photographs he took of it - photography is another of his hobbies - suggested to him the writing of a descriptive article about the plant. House and Garden magazine bought it, and this encouraged him to further writing.

His next article, on the genus Calochortus, lead to his becoming acquainted with Mrs. C. I. DeBevoise of Greens Farms, Connecticut, who was interested in obtaining plants of the Great Plains region. She encouraged him to start a nursery, and in 1932 she helped him do so by mailing out his plant list with hers, by providing the bulk of the orders for the first few years, and by introducing him to the methods of packing plants for shipment. Other plantsmen added their encouragement, advising him that plains plants were even better adapted climatically to the East, where most gardening was done, than were those of the Rocky Mountains. From the 78 kinds of plants offered in the original lists, the number has now increased to 196 different kinds. The value and volume of his sales have increased steadily over the years since 1932, but the native plant nursery still ranks as a sideline, though an important one, to his principal business of cattle ranching.

Exploring for plants has been the most pleasure-awarding aspect of his hobby-business. His first listing of many species has actually often been their original introduction into horticulture, and for even a larger number he has for many years been the most dependably and consistently - frequently the only - available source. In addition to the usual or "normal" types of the wild plants, unusual variations in habit, color, or form have been the object of his quest. The search for these has added "close observation, discrimination, purpose, and zest" to his "best of all hobbies," he has reported. Mrs. J. Norman Henry of Pennsylvania, well-known for her untiring and enthusiastic championship of native American plants as horticultural subjects, was especially influential in directing his attention to such horticulturally desirable forms. His recent lists have included such selected clones as: a dark-rose form of Antennaria rosea; Aster Kumleinii 'Dream of Beauty' (pink-flowered); Aster Geyeri 'Black Hills', a superior large-flowered strain; a pink-flowered variant of Clematis Scottii; Dodecatheon pulchellum 'Prairie Ruby' (intense-red) and D. pulchellum 'White Comet' (white-flowered); Erigeron flagellaris 'Prairie Gem', a diminished, less invasive form; a cream-white selection of the usually lavender-pink Phlox alyssifolia; white, lavender and powder blue forms of Phlox andicola; several selected color forms of Tradescantia bracteata; Viola vallicola 'Gold Nugget', a tetraploid form; Rosa arkansana 'J. W. Fargo' (a lovely multiple-petaled tetraploid, named by N. E. Hansen).

Many gardeners, especially of the Northeast, may think of cacti as strictly window-sill or greenhouse plants, and so will be

surprised to learn that quite a few species are old inhabitants of the bad lands and high plains of South Dakota and nearby states. Mr. Barr finds among his customers an ever-increasing interest in these cold climate cacti, of which he lists at present ten different species, as well as several color selections of these and also a few hybrids. The flower-color range in these hardy sorts now extends from yellowish-green through various shades of yellow and orange to pinks and carmine red, with a few bicolors for good measure.

On two occasions, Dr. Edgar T. Wherry, the monographer of the genus Phlox, visited with Claude Barr, and together the two men studied the phloxes of Barr's region in the wild. "I treasure the privilege," Mr. Barr has told us in referring to the results of Dr. Wherry's studies, "of being instrumental in retaining recognition of P. scleranthifolia, in demonstrating the garden value of P. alyssifolia, in aiding in the recognition of P. andicola parvula and in discovering the occurence of P. muscoides and P. scleranthifolia in Nebraska."

This experience and others have reinforced his interest in his long-term project of writing a volume about the Great Plains plants from the point of view of their garden value. He intends it as a counterpart to Ira N. Gabrielson's Western American Alpines, a copy of which Mrs. DeBevoise gave him in the early 1930's. His studies toward that end have continued since that date, but slowly, since, as he puts it, "Although the nursery business doubtless has been the very best possible aid to this study, yet plant growing and selling and cattle raising, still an economic necessity, effectively exclude the writing project." The publication of his Jewels of the Plains will be a rewarding culmination to the years of engrossing observation of these plants in their native wilds and under cultivation.

Certainly he has had wide experience with these wild plants in the garden. In his relatively dry climate, with difficult basic soil and scant water, he has had to modify the soil and has learned to cultivate, space, and shade many plants so as to manage the moisture supply properly. Last year he built a new slat house, 24 × 58 feet, which, with its lower temperatures, greature humidity, and lessened soil-moisture evaporation, will enable plants to flourish that barely exist in the open in his area, even with modified soil.

Of the plants he offers, Mr. Barr estimates that nearly twenty percent come directly from the wild on his own property, "where in favorable situations Nature produces quality plants in abundance." The balance are produced on the premises for sale. Plants obtained from other collectors are never offered until they have been grown in his garden and determined true to name. The areas from which he draws plants include the Great Plains, which provide better than 90 percent of his stock, the Rocky Mountains and South-

west (4 percent), and the area east of the Plains border (another 4 percent) - with an occasional plant from Europe.

It is not surprising that Mr. Barr's interests, in addition to his cattle, plants, and photography, should include geology and rock-collecting. He has spent much of his life in an area where hill and plain meet and where weather is the most important phenomenon one deals with. He finds geography and geology, particularly geological processes, fascinating. He and Mrs. Barr have a collection of several hundred agates they have found on their own property - and have acquired in addition a collection of agate-hunting friends who roam their pastures in search of the stones.

As a rancher, Mr. Barr naturally takes part in community affairs that affect his interests. For many years he has served on the Fall River County Farm Bureau Board of Directors and for six years on the Board of Directors of the State Farm Bureau Federation.

Fittingly, on the twenty-fifth of this month, in Madison, South Dakota, the South Dakota Horticultural Society presented to Claude Barr the Robertson Award for 1958, for significant achievement in plains floriculture.

Liberty Hyde Bailey, the Humanist[1]

Curtis C. Page
Professor of English
Drake University

We have all of us today been pressed not to let ourselves descend to mere eulogy. For we have met, we know, to celebrate, on the centennial of his birth, the life of a very great man. About his greatness, his prodigious output, his reverberating influence, we have heard much today. A mere catalogue of his achievements, indeed so simple a listing as that which designates his kinds of activity, amazes belief. He named - how many species of plants? Most of you can remember a largesse of endless hours given to your specialty, your problems. His unrelenting energy produced books and articles which number well over one thousand. The categories, the numbers, the rosters appear never to end.

I have been asked to tell you of the humanist in Liberty Hyde Bailey. I shall try to - in a moment, for first I must admit my concern, as a fellow celebrant with you, and particularly as his biographer with George Lawrence - my concern lest in speaking of him as a great man, we consider the practical greatness only and forget the man, the isolate human being. I do not accuse any of us of forgetting; I simply wish to give his humanness towering emphasis, for otherwise I cannot explain his humanism. Liberty Hyde Bailey was not a scientific or editorial or administrative machine; he was a man. He can be for us nothing if he is only a name to conjure with, a book to consult, an image to praise. He will be nothing, I think, if he is not seen as a human being who sweated and doubted, who regretted and failed, who must have been as lonely as we all are.

One can speak of another person, at the last, only for oneself, and I shall, properly, be personal. You all have your own electric memories of him - this has been one of the warm recurrent motifs of this day. I stand here because sixteen years ago I had the good sense to ask his granddaughter Ann to marry me. The succeeding years - his last, remember - were full of hearing about him from

[1] An address delivered at Cornell University, March 14, 1958, on the occasion of the celebration of the Liberty Hyde Bailey Centennial.

family, seeing him, talking with him. He was, to me, always a kind and generous gentleman. He was, I knew, a Man, come long since to the image of the father he had always revered and held in awe. He knew where he stood and without evasion declared himself. He spoke with precision and care - I never heard him use a contraction; he walked always erect; he respected the opinions of others; he honored truth.

He was, in private life, it will surprise no one at Cornell to hear, stubborn. During the war, for instance, only a prolonged and canny war of nerves by Ethel and Ann kept him from daily stoking the monstrous furnace at Sage Place - he was 88! He greeted Andrew Denny Rogers' fine scientific biography of him with, "Lot of nonsense to write it. I shall not read it," and ever refused to admit that its well-thumbed condition as it sat on his reading table was any of his doing!

He was, as you know, a gifted reader and raconteur, with almost bardic power. I recall his appearance, frequently, at a story's end: breathless, almost in tears, his deep chin quivering with excitement - not so much about the sentiment or the content as about the drama of the gleeful climax. And I saw there his magnetism. He had always, without falsity, played to the gallery, or made the dramatic gesture to gain valid ends. He always, I am sure, consciously cultivated reputation as a character spicefully, though guardedly, eccentric. He loved an audience. He was a showman.

He had a vibrant sense of humor. He had, too, a delicious sense of nonsense and fun. Ann recalls one Christmas present: a large box, inside it another, and another, and on to a final tissue-wrapped woody fibre with an attached note, "The stem of the apple what I et." A favorite game with his children involved hiding them in, say, a closet and then, with loud puzzlement, trying to find them!

Perhaps I remember most urgently his pride, when, before he became bedridden, he went, in habit and hope, to the office and tried to work. If one came upon him unexpectedly, to see him dozing, or gazing out the window, he would quickly pull himself erect and address himself busily to work laid before him. The same pride had led him, many years before, to submit a novel to two publishers pseudonymously, refusing to capitalize on his reputation. Consider the hope and fear in which he did this, and the private pain which never let him tell of the two rejections. This pride and his stubbornness grew - in the last years he could no longer tolerate joshing. But a steel will and a sense of bravura kept him going, assuring himself the next trip would be made, refusing to admit his powers were going.

To himself, we believe, however, he admitted all, and his spirit declined gravely and warmly to sentiment, and vivid memories of his father, and of the other days on the great frontier. All I saw, and all I have learned of him, hold this kind of ironic and bittersweet suggestion. Because I knew him, his power and his fragility, his pride and his humility, his greatness and his humanness, I am myself calmer, sensing our kinship and thence being reassured about my own potential, and my due share in Man's moral triumph over necessity and his senses and his daily inadequacies and failures. I am grateful for having known him as a simple human, stimulating, dear, fallible, admirable, ultimately enigmatic.

Was not this man inevitably a humanist? Vitally and centrally knowing his own integrity, of which pride and stubbornness were the quite proper shows, an egoist in the best sense, acutely aware of himself and others (he once looked long at my then one-year-old son and said to me, "The beginning and the end of life."), deeply sensitive to others, as students or equals - or as audience, he valued human life. He was totally awake to the ironies of that life, but he valued it profoundly - and most reverently in that he was not ashamed of emotion or clear sentiment. Listen to him, ten years ago, as he closed his last public address: "It is a marvelous planet on which we ride. It is a great privilege to live thereon, to partake in the journey, and to experience its goodness.... My life has been a continuous fulfillment of dreams." For this man human life was the touchstone, and the human habitation and hearthstone and place its beloved setting.

And he was inevitably a humanist in his respect for truth - or, rather, for the dogged, flexible search for it. He was always open, waiting, listening for its step. He rarely dogmatized, except to contemn hypocrisy, evasion, intolerance, or stupidity - all of them erosions of an obligation in the human spirit to fulfill itself.

He was, further, always a propagandist, a public man, a canny politician, an eager and effective leader. But the great events he moved were never merely busy; they were valuable, because he acted always in accord with a knowledge of responsibility to his fellows, because they were products of a working philosophy. Liberty Hyde Bailey was a humanist in the great tradition, a believer that mind and will must exercise exclusively in terms of human affairs, toward human good. This is the humanism to which Goethe's Faust came, who trusted the free inquiry of secular science but found that learning is sterile if not informed by feeling, who was finally able to find joy in altruistic action strikingly like that which characterized all of Grandfather's life. Do you recall

Faust's final actions on earth in the drama? He is reclaiming swamp land, creating order and fertility where there had been chaos and sterility, creating land congenial to man, arable land fit for a New Jerusalem. The parallels continue - for Faust as Man a life of striving, of pure endeavor, was laid down, a life of constant development which no personal pleasure or smug satisfaction could be permitted to check. Grandfather had, to be sure, no Mephistopheles, unless it be that his kindness and joy tell us what the drama does - that the real evil is mockery, contempt, presumption. Finally, even Goethe's core statement about Faust, "Man must strive, and striving he must err," illuminates for us. For I must judge that Grandfather in a sense erred insofar as his humanism, his altruism were, in the main, directed toward man in the abstract. Perhaps this is necessarily true of great doers of good - it was certainly true of Ghandi. Those close to him were taken often for granted, on the assumption that they should and would yield, and contribute, to the whirlwind fulfillment of his moving passion.

This passion was, again, pervasively humanistic. He believed in no orthodox God or creation. He once wrote:

> All beliefs, all doctrines, all creeds are mine. I want only the truth and the privilege to live in the great good world.... It is not my part to be anxious about destiny or about the universe. ... The universe is in better hands than mine. In these matters, I will substitute trust for faith....
>
> Passengers on the cosmic sea
> We know not whence nor whither:
> 'Tis happiness enough to be
> In tune with wind and weather.

- and "...it is doubtful whether the mind of man can ever understand the universe." Man is not given to know. His obligation, therefore, is to make of this world what he can. Religion for Grandfather consisted of those "actions, purposes, and experiences which are humanly significant." He made no distinction between the secular and the sacred, for man, by himself, must and can bring to pass the world of his vision.

The books of which Liberty Hyde Bailey was, we think, most proud were The Background Books: The Holy Earth, Wind and Weather, Universal Service, What Is Democracy?, and The Seven Stars. The very titles state their common sovereign purpose - they tell of "The Philosophy of the Holy Earth" which nourished, sustained, and validated his scientific publication. Many of you have seen The Holy Earth - it has been often referred to today. I would direct your attention for a moment to The Seven Stars, a

volume less widely known. You should read it. Its style is erratic - it rambles conversationally, and shifts toward and away from rhapsody, but it tells of a breathing mind, it has the texture of a human heart. It describes the search for values of a college youth, dissatisfied with materialism and conformity and mere factual knowledge, who finds after introspection and communion that, finally, the highest goods are service and a motivating love of beauty which will together establish the foundations of a spiritually satisfying life for all, not merely for the few. He wrote, strangely in prophesy:

> Civilization lies not in institutions and long familiar routines, but in the soul of man. If catastrophe come and the end of all things seem at hand, yet will men remember their little precious arts, fires will be lighted on hearths, fingers will again express the soul, and the best aspirations will slowly take form. Perhaps the new order would be good.

Read this book - it is clear-running, surgical in its criticisms of our culture, and - let me not be ashamed of emotion - exultant.

It was after these motives that Liberty Bailey worked. At the end of every path he walked was social good. The regimen of pure scientific research was necessary, but science was valid only as its results were turned to practical human uses. Scientific literature must be made readable by the layman if he is to understand the world about which he is obliged to make decisions. Agricultural education must be grounded in a growing body of fact, but it must reach the young and proceed with enthusiasm and dedication.

His humanism, finally, had never as its end simply man's comfort, or utility. It pointed always toward the environment necessary to expansive creativity. He wrote:

> To find the beauty in labor, in objects, in actions, in sensations, in sentiments, in situations, to keep the earth clean, is a real quest, worthy and enduring.... This is the supreme manifestation of living. The highest beauty is the beauty of good personality.

Education and the full life were for him no special privilege of the male, or the city-dweller, or the lucky. And a farmer or extension agent was a cipher who had not taste, manners, respect for his fellows, a sense of beauty.

Like Carlyle, he believed the final and best guide to be the poet - the humanistic maker of value and legislator of joy. He was a pleasant poet himself, writing principally while Dean, as outlet for the tensions of that office. The poems are not of the first rank,

but they sing and ring his ultimate message to us - kinship and serenity. Let me close quietly with the lone man again writing for us all in his poem "Undertone":

From morning till night and everywhere
My days are full of their effort and care;
Full of labors to drive and schemes to test,
Of work to finish and knowledge to wrest;
And the known result of this noise and strife
Is what men and the world all call my life, -
This is the meed of the work that I own
Outspread on my life as an overtone.

But ever there runs through the work I own
The all-silent stream of an undertone.
This stream is myself as my life I live
And out of it flows all the strength I give.
It's the tone of hills and calm of the plain
The smell of the soil and the touch of rain;
'Tis a careful thought of the calm sweet grass,
An abiding joy in the birds that pass....
'Tis appeal of frost and the fragile dew,
Of the passing clouds and the depths of blue;-
Then a quiet heart that can give no sign
Of the sacred calms that are only mine,
Or the gentle sins that are part of me
As the silent twigs are part of the tree,
Or memories deep I cannot express
Any more than the tree in its wild'rness.

The peace of the winds is my undertone-
I move with the crowd, but I live alone.

Chromosome Numbers in the Gesneriaceae[1]

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Chromosome numbers in the Gesneriaceae have been reported previously for about seven percent of the 1,200 described species and eighteen percent of the 120 genera (1, 2, 4, 8; see 1 and 8 for summary lists and other references).

This paper reports counts for fifty plants of the Gesneriaceae representing twenty genera and thirty-six described species. Nine of the genera and thirty-four of the species are reported for the first time. However, these counts, plus those previously reported, represent only about nine percent of the species and twenty-five percent of the genera. This apparent cytological neglect of the family stems from its lack of economic importance aside from some use as a source of ornamentals and from the fact that its distribution is primarily in the tropics and subtropics (often in inaccessible locations). Because they are plants of warm, humid climates, living specimens can be grown in the temperate zone only indoors, restricting the numbers of plants available for study.

Almost all reports of chromosome numbers have been made by botanists working with plants in cultivation in the temperate zone, and often a count has been based on only a single plant (2, 8, this study). In addition, a considerable amount of taxonomic confusion exists in the family, and many synonyms and horticultural names are current. Some of these have been used in reporting the chromosome counts, making it difficult to identify correctly some species referred to in the literature (Professor H. E. Moore, Jr., personal communication). Not all authors have prepared herbarium specimens of plants studied, and so it is sometimes impossible to check the identification of plants in cases where it appears likely an incorrect binomial has been used. For these reasons the counts

[1] The study on which this paper is based was made in partial fulfillment of the requirements for the degree of Master of Science in the Department of Botany at Cornell University, and was carried out under a grant received from Longwood Gardens, Kennett Square, Pennsylvania.

The author wishes to acknowledge the guidance given by Dr. Charles H. Uhl during this study. Thanks are due also to Dr. Harold E. Moore, Jr., for the loan of the manuscript of his "African Violets, Gloxinias and their relatives" prior to its publication.

which have been reported do not represent wide samples from natural populations nor do they necessarily represent the condition of the species in the wild, and in some cases may not even represent the species listed.

A knowledge of chromosome numbers serves primarily as a handmaid to other botanical, genetical, and cytological problems. Thus, the counts reported here will be useful to the extent that this information is helpful in other areas of investigation. Also, the meager bases on which the present information is founded require that it be used with its limitations in mind.

Materials and Methods

Plants used in this present study were obtained from the Cornell University greenhouses; from Longwood Gardens, Kennett Square, Pennsylvania; and from Paul Arnold, Binghamton, New York. In the greater number of cases the original sources of the plants were not known, and only one plant of each species or variety was available for study. Chromosome counts were made from squashes of sporocytes or of root tips. The former were preferred, since the somatic chromosomes are small in many species. The material was fixed overnight in modified Carnoy's solution (3 parts chloroform : 2 parts absolute alcohol : 1 part acetic acid), then squashed in aceto-carmine or aceto-orcein. Slides were made permanent by the modified McClintock method (9). Herbarium specimens have been filed with the Bailey Hortorium at Cornell University, except for Titanotrichum Oldhamii and Smithiantha 'Golden King'. Plants were identified by Professor H. E. Moore, Jr.

The table on page 123 lists the chromosome numbers determined in this study. Numbers under the "n" column indicate gametic numbers obtained in sporocyte counts, those in the "2n" column are somatic numbers from root tips. The origin of plants from the wild are given under "source," where known. In a few cases, marked by an asterisk, plants had not flowered and identification was uncertain. In several instances the chromosome number of clonotypes - that is, plants vegetatively propagated from the same clone as the type specimen - were counted. These are marked by a double asterisk.

Camera lucida drawings at a magnification of 2400 × appear on pages 120 and 122.

Discussion

Chromosome numbers reported in the Gesneriaceae range from 2n = 16 (in Nematanthus longipes) to 2n = 72 (in Ramonda serbica). The subfamily Cyrtandroideae has a wholly superior ovary and includes all the Old World species as well as the New World sections Columneae, Anetantheae, and the subsection Mitrariinae of the

section Coronanthereae. In this subfamily gametic numbers of 8, 9, 10, 14, 15, 16, 17, 18, and 20 and a few polyploids have been reported. The other subfamily, Gesnerioideae, has a partly or wholly inferior ovary, and occurs only in the Americas. Gametic numbers reported in this subfamily are 11, 12, 13, and 14, with a few polyploids. (Gametic numbers in some cases are inferred from reported somatic counts.)

The cytological study of the Gesneriaceae is still in its infancy, and it is premature to reach any sweeping conclusions on chromosome numbers in various taxa of this family. The small fraction of species studied cytologically, and the fact that these studies have been based frequently on single plants, usually of horticultural origin and sometimes of uncertain identification, mean that additional observations, preferably on natural populations, are needed to establish definitely the basic chromosome numbers and the extent of heteroploidy in the various taxa.

Nevertheless, some patterns are beginning to emerge in certain groups in which a number of species have been sampled. For instance, even though chromosome numbers for the species studied in a given genus may have been based on no more than one plant of each of those species, when the same chromosome number is found in each this is considered to indicate a basic chromosome number for that genus. On this basis it appears likely that the following genera have a basic chromosome number as listed below:

Saintpaulia

Eleven species of Saintpaulia have been described (6). Chromosome counts of eight species, including S. ionantha, and of well over a dozen horticultural varieties are known. Of twenty-nine reported counts, twenty-four are n = 15 or 2n = 30. Three cultivars with 2n = 60 are clearly tetraploids. Although a count of n = 14 and another of 2n = 28 also have been reported for S. ionantha (3, 8), it is believed that these are in error, particularly since Saintpaulia chromosomes are small and difficult to count (10). A number of successful interspecific crosses have been reported (8; also, Professor Sheldon C. Reed, personal communication) and a large number of cultivated varieties have arisen. The ease of hybridization in cultivation suggests a close genetic relationship between some species. Since n = 15 has been reported for eight of the eleven described species, it appears probable that this number is basic for the genus.

Columnea

Chromosome counts for sixteen of the 125 described species, and counts of several interspecific hybrids, indicate that a basic number in the genus is probably 9. Twenty counts report 2n = 18, one count 2n = 36. The source of this latter plant (C. sanguinea) is

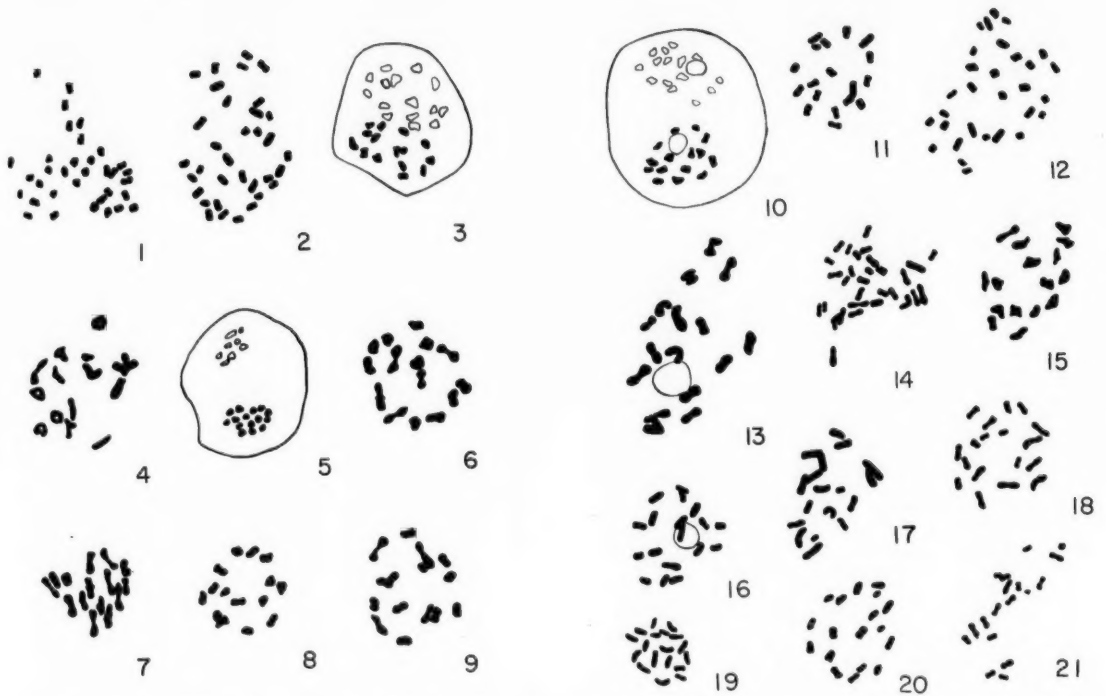

Fig. 22. Diagrams of karyotypes in the Gesneriaceae, ×2400. 1, Petrocosmea Kerrii (2n=34). 2, P. Parryorum (2n=34). 3, Saintpaulia amaniensis (n=15). 4, S. confusa (n=15). 5, S. magungensis (n=15). 6, S. orbicularis (n=15). 7, S. shumensis (n=15). 8, Saintpaulia sp. from Tanganyika (n=15). 9, Saintpaulia 'Snow Prince' (n=15). 10, Saintpaulia 'Snow Prince Supreme'(n=15). 11, Chirita Trailliana(2n=18). 12, Aeschynanthus longiflorus (2n=30). 13, Agalmyla parasitica (n=16). 14, Lysionotus serratus (2n=32). 15, Codonanthe crassifolia (n=16). 16, Columnea affinis (2n=18). 17, C. Allenii (2n=18). 18, C. arguta (2n=18). 19, C. crassifolia (2n=18). 20, C. linearis (2n=18). 21, C. Oerstediana (2n=18).

not known. Some interspecific hybridizations have been reported (5, 7), so certain species apparently are closely related genetically.

Counts of n = 9 or 2n = 18 also have been reported for other genera in the tribe Columneae. These are: Alloplectus, three counts; Drymonia, two counts; Episcia, fourteen counts; Hypocyrta, one count; Nautilocalyx, three counts, plus one count of 2n = 36, and another of 2n = ca. 34-36. However, two other genera in the tribe, Codonanthe and Nematanthus, are reported to have numbers of n = 16 and 2n = 16 respectively. Both counts are based on single plants.

Kohleria

Ten counts, including three for interspecific hybrids, have been reported for the genus Kohleria. All counts are either n = 13 or 2n = 26. Extensive hybridization has been carried on in the genus, suggesting an extremely close genetic affinity between some species. Thirteen is probably a basic number in the genus.

Smithiantha

This is another genus that has been hybridized extensively, and most material in cultivation is of hybrid origin (5). All six counts reported for this genus are n = 12 or 2n = 24, indicating a basic number of 12.

Achimenes

Eight reports on Achimenes give counts of n = 11 or 2n = 22, and 11 probably is a basic number in the genus. In addition, other numbers have been reported. For instance, A. Ehrenbergii appears to have 2n = 24, which is interesting in view of the fact that there are reports of hybrids between this species and Smithiantha zebrina (5) which has 2n = 24 (8). Also, of two plants labeled A. Skinneri obtained from Paul Arnold of Binghamton, New York, one marked "F. Carrell" appeared to have 2n = ±22, whereas the other marked "Cornell" appeared to have 2n = ±34. Finally, in A. pedunculata a definite count could not be determined, but it, too, appeared to have 2n = ±34. Achimenes have been highly hybridized for over a century and a large number of horticultural varieties have been developed. Therefore, whether the apparent chromosome series based on cultivated material occur in nature or are the result of hybridization could not be determined from the material available. Further studies with larger samples from natural populations are needed to determine whether polyploid and/or aneuploid races are to be found in Achimenes.

Rechsteineria and Sinningia

Five counts have been reported for Rechsteineria, four being n = 13 and one n = 14. In Sinningia, of nine counts reported six

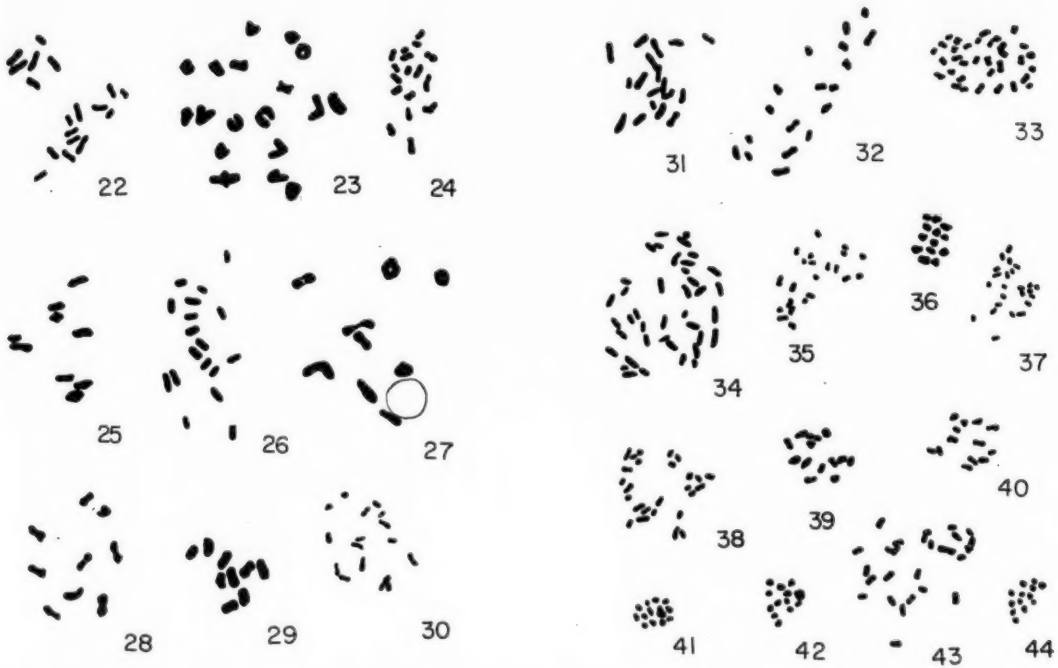

Fig. 23. Diagrams of karyotypes in the Gesneriaceae, ×2400. 22, Columnea pilosissima (2n=18). 23, C. sanguinea (n=18). 24, C. tulae 'Flava' (2n=18). 25, C. ×euphora (n=9). 26, Columnea sp. labeled Columnea II (2n=18). 27, Drymonia sp. (n=9). 28, Episcia dianthiflora (n=9). 29, Episcia 'Tetra' (n=9). 30, Nematanthus longipes (2n=16). [31, 32 Episcia hybrids (2n=18).] 33, Opithandra primuloides (2n=34). 34, Titanotrichum Oldhamii (2n=±40). 35, Achimenes misera (2n=22). 36, Koellikeria erinoides (n=12). 37, Smithiantha multiflora (2n=34). 38, Diastema vexans (2n=26). 39, Kohleria bogotensis (n=12). 40, Kohleria 'Cecilia' (n=12). 41, Rechsteineria Lindleyi (n=13). 42, R. Warszewiczii (n=12). 43, Sinningia barbata (2n=26). 44, ×Gloxinera "sp." (n=13).

are n = 13 or 2n = 26, while three are either n = 28 or 2n = 28. No explanation for these reported differences in chromosome numbers is at present possible because of meager information. However, hybridization within both genera has been extensive, and cultivated species have often been misidentified in the literature (5).

Not only have interspecific hybrids been produced in Rechsteineria and Sinningia, but a number of intergeneric hybrids have been reported in the literature and many seem fairly well substantiated on morphological grounds. This suggests a close genetic affinity between these genera. It seems likely that 13 is a basic number in both genera.

The many interspecific hybrids reported in Saintpaulia, Streptocarpus, Achimenes, Kohleria, Sinningia, Smithiantha, and Columnea suggest that genetic barriers are weak between many species of these genera.

SOME NUMBERS IN THE GESNERIACEAE

Species	Source	n	2n
I. Subfamily Cyrtandroideae			
Tribe Ramondeae			
Petrocosmea Kerrii Craib			34
Petrocosmea Parryorum C.E.C.Fisch			34
Saintpaulia amaniensis E.P.Roberts**	Usambara Mts. near Amani, Tanganyika	15	
Saintpaulia confusa B.L.Burtt		15	
Saintpaulia magungensis E.P.Roberts**	Magunga, Usambara Mts., Tanganyika	15	
Saintpaulia orbicularis B.L.Burtt		15	
Saintpaulia shumensis B.L.Burtt	West Usambaras, Schume, Tanganyika	15	
Saintpaulia sp. from Tanganyika	Amboni near Tanga, Siga Caves, Tanganyika, via Univ. of Calif.Bot.Gardens	15	
Saintpaulia cultivars:			
'Snow Prince'		15	
'Snow Prince Supreme'		15	
Tribe Didymocarpeae			
Chirita Trailliana Forrest and W.W.Sm.			18
Tribe Trichosporeae			
Aeschynanthus longiflorus DC.			30
Agalmyla parasitica (Lam.) Kuntze		16	
Lysionotus serratus D.Don			32

* Identification not verified
** Clonotype

Species	Source	n	2n
Tribe Columneae			
Codonanthe crassifolia (Focke) Morton	Panama, in or near the Canal Zone	16	
Columnea affinis Morton	Wild		18
Columnea Allenii Morton	Province of Coclé, Panama		18
Columnea arguta Morton	Province of Coclé, Panama		18
Columnea crassifolia A. Brongn.	Guatemala		18
Columnea linearis Oerst.	Sarapiqui Valley, Costa Rica		18
Columnea Oerstediana Kl. et Hanst.*			18
Columnea pilosissima Standl.*	Wild		18
Columnea sanguinea (Pers.) Hanst.		18	36
Columnea tulae Urb. cv. 'Flava'			18
Columnea × euphora H.E. Moore**		9	
Columnea sp. labeled Columnea II			18
Drymonia sp.		9	
Episcia dianthiflora H.E. Moore and R.G. Wilson	Guerrero, Mexico	9	
Episcia cupreata (Hook.) Hanst. cv. 'Emerald Queen'			18
Episcia reptans Mart. cv. 'Lady Lou'			18
Episcia cv. 'Tetra'		9	
Nematanthus longipes DC.			16
Not referable to Fritsch's classification			
Opithandra primuloides (Miq.) B.L. Burtt	Japan		34
Titanotrichum Oldhamii (Hemsl.) Solered.			±40
II. Subfamily Gesnerioideae			
Tribe Gloxinieae			
Achimenes Ehrenbergii (Hanst.) H.E. Moore			±24
Achimenes misera Lindl.			22
Achimenes pedunculata Benth.			±34
Achimenes Skinneri Lindl.			±22, ±34
Koellikeria erinoides (DC.) Mansf.	Venezuela	13	
Smithiantha multiflora (Martens & Galeotti) Fritsch			24
Smithiantha cv. 'Golden King'		12	

Species	Source	n	2n
Tribe Kohlerieae			
Diastema vexans H.E.Moore	Colombia		26
Kohleria bogotensis (Nichols.) Fritsch		13	
Kohleria cv. 'Cecilia'		13	
Tribe Sinningieae			
Rechsteineria Lindleyi (Hook.) Fritsch		13	
Rechsteineria Warszewiczii (Bouché & Hanst.) Kuntze		13	
Sinningia barbata (Nees & Mart.) Nichols.			26
× Gloxinera "sp."		13	

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FRUITS OF ACANTHOPANAX SIEBOLDIANUS

The not uncommon shrub, Acanthopanax Sieboldianus, the fiveleaf aralia, as grown in this country is apparently all vegetatively propagated from plant material received nearly a century ago. This material is recorded as pistillate, and no fruit or seed has been expected because of lack of staminate plants. Bernard Harkness, of Rochester Parks, in Baileya 1: 102, 1953, has remarked, "Why in this long span of time no one has been curious enough to bring over a staminate plant to see whether fruits would not enhance the ornamental value of fiveleaf aralia is a mystery." It is a strange coincidence that on August 16 of last year (1957) I found a shrub of the fiveleaf aralia with fruit on it, growing in Highland Park at Rochester, a stone's throw from Mr. Harkness's headquarters.

The stalks of the umbels are 4-5 cm. long, the individual fruit-pedicels about 1 cm. long. The fruits are black and when dried are five-angled, the cross-section looking like a star in outline. Disc and style remain on the fruit, which is spherical and, when dried, about 5 mm. in diameter. There are five seeds to one fruit, each seed about 5 mm. long, flat and thin with one edge very straight.

It is very probable that A. Sieboldianus is polygamodioecious. Mr. Joseph Monachino, taxonomist at the New York Botanical Garden, tells me he saw a shrub of it in flower and later in fruit this year in New York City but did not examine the flowers or the fruit. After some inquiry I have not been able to find any record of any seed having been previously collected in this country.

It seems inherent in both monoecious and dioecious plants sometimes to produce perfect flowers. Therefore, species that have been recorded originally as dioecious or monoecious may have later observers correct the description to read polygamodioecious or polygamomonoecious. It should come as no surprise to anyone to find perfect flowers in a species that ordinarily has the sexes separate.

On the other hand, species with usually perfect flowers may occasionally develop functionally unisexual flowers on a whole plant, such as a plant of Stachyurus we have here that is functionally pistillate.

Of course, with regard to the fiveleaf aralia, there is also the possibility of apomixis, or the production of fruit without fertilization, which may occur in either unisexual or bisexual plants at times - but this is probably not the case here. Time may soon tell, with observation, how frequently perfect flowers are formed in the fiveleaf aralia and how effective pollen will be in producing fruit, and whether fruit is useful or ornamental.

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Book Review

"The Guide to Garden Flowers" by Norman Taylor. 315 pp., with 324 species illustrated in color and 88 in black-and-white by Eduardo Salgado. Houghton Mifflin Co., Boston. Price: $4.95.

The demand for a nontechnical book that will help the inexperienced layman to "know" the trees or the wildflowers or garden plants seems to be perennial, and luckily someone willing and often able periodically turns up to write one. There is no doubt that there is a need and a market for such books, and in the field of garden flowers Mr. Taylor's newest book will prove useful to many, for it is largely factual. The many little inaccuracies are so well embedded in the larger mass of valid information that most of the book's users, lacking the experience and knowledge to be critical, will pass over them quite unaware.

As stated in the preface, this book has two aims: "to make the identification of garden flowers as painless as possible [and] to provide such cultural notes that growing them will be easy for all." The greater portion of the text comprises descriptions of selected (412) species of (mostly) herbaceous garden plants, listed by common name. For each are given also the scientific name, geographical origin, a generalized description, varieties available, etc., as well as cultural instructions; the names and a few words of description of one or a few other species of the same genus are usually appended. The general arrangement of all these is by families, but not consistently so. Finding lists arranged by situation preferences, height, season of bloom, fragrance, flower color, etc. are provided.

Since the author's expressed aim is "to help the seeker, not to sink him in a morass of technicalities" as the "experts" (botanists) are wont to do, he has presented the reader with a nontechnical key to the garden flowers included in his book. What he has devised is potentially another kind of morass, however, treacherous because it is based on awkward or meaningless terminology, inconsistencies, and inaccuracies. Several times, for example, a distinction is made in the key between symmetrical and unsymmetrical

flowers, and though the author equates the latter term with "irregular" and "one-sided"(!) (in attempting to express the meaning of "zygomorphic" without using that term), a belated consultation of a dictionary will show that zygomorphic flowers are quite symmetrical. The "Everlastings," for some reason, are keyed out separately from their families, solely on the basis of their "chaffy" flowers; here one finds grouped various composites with chaffy involucres but flowers of quite normal texture, and also Lunaria annua! "Daisy-like is another of Mr. Taylor's favorite nontechnical terms; what he has in mind is not always clear, as when globe-amaranth falls under the term, and as in the muddled lead-phrase "Flowers daisy-like, . . . crowded in a head."

A few examples will suffice to illustrate the types of inaccuracies, previously alluded to, to be found throughout the text. Fuchsia (p. 155) is separated from other members of the Onagraceae on the basis of its irregular [!] flowers: "Most of the plants of this family have perfectly regular flowers, but Fuchsia does not, as one petal is often lacking [?] and the flower is pendulous"). The flowers of Colchicum autumnale (p. 11) are said to be "followed . . . by its narrow, grasslike leaves." This will surprise many gardeners who must cope each spring with the coarse lusty foliage of Colchicum. Crocus 'Yellow Mammoth' (p. 10) is listed as a variety of C. vernus; actually, the latter does not occur in a yellow form, and this variety is the same as C. flava (called C. aureus in the text). One pretty good way to deprive oneself of Iris cristata would be to follow the book's directions (p. 33) to "plant [its] rootstocks 2-3 inches deep." (There is a white variety of this available, by the way, though Taylor says, "Varieties: None.")

The small figures used as illustrations, prepared by Eduardo Salgado, are extremely attractive as well as quite accurate. The color work is very fine. (Fig. 3 opposite p. 237 is not Cotula squalida, but probably C. coronopifolia; fig. 2 does not seem much like true Artemisia Stelleriana.) Probably, after all, the most painless way for the novice to identify a particular plant will be leafing through the illustrations until he finds one which matches his unknown.

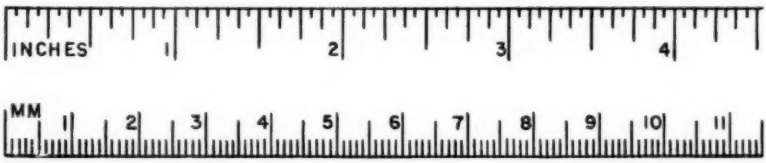
W. J. D.

ABBREVIATIONS USED IN BAILEYA

ann.	annual	dm.	decimeter	lf.	leaf
bien.	biennial	fl.	flower	lft.	leaflet
br.	branch	fls.	flowers	lvs.	leaves
brt.	branchlet	flt.	floret	mm.	millimeter
caps.	capsule	fr.	fruit	per.	perennial
cl.	clone	ft.	foot	segm.	segment
cm.	centimeter	hort.	horticultural	st.	stem
cv.	cultivar	in.	inch	sts.	stems
diam.	diameter	infl.	inflorescence	var.	variety

METRIC - ENGLISH EQUIVALENTS (approximate)

6 mm. - 1/4 in.	10 cm. - 4 in.	10 mm. - 1 cm.
12 mm. - 1/2 in.	1 dm. - 4 in.	10 cm. - 1 dm.
25 mm. - 1 in.	3 dm. - 1 ft.	10 dm. - 1 meter
2.5 cm. - 1 in.	10 dm. - 1 yd.	
5 cm. - 2 in.	1 m. - 39 in.	



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